

The Panels

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MINISTRY OF
AGRICULTURE, FISHERIES AND FOOD
NATIONAL AGRICULTURAL ADVISORY SERVICE

National Livestock Breeding Conference

HARROGATE

7, 8 and 9 NOVEMBER, 1962

LONDON

HER MAJESTY'S STATIONERY OFFICE
1963

Foreword

Surveying the possibilities of developments in the field of livestock improvement, it became clear that an opportunity should be provided to bring together all sections of the industry with a common interest in, but uncommon approach to, livestock improvement; hence the Harrogate Conference.

For two days pedigree breeders, geneticists, commercial farmers and advisers met together with the declared intention of reviewing progress in livestock breeding and discussing steps which might be taken not only to stimulate interest but also to develop new approaches.

They were helped greatly in their discussions by reports which had been prepared earlier by small working parties dealing with three large sectors of the livestock industry, beef cattle, dairy cattle and sheep. These reports reviewed the current position and indicated possible action for the future. They proved invaluable in the discussions.

Now that the Conference is over, discussions must lead to action. The aims and objectives of livestock breeding in this country have been clarified and defined and a wide measure of agreement reached. The way is now clear for breeders, scientists and organizations concerned with breeding to get together at round table discussions to plan future action. While I would hope that those mainly concerned will come together of their own volition, none the less I am prepared for the National Agricultural Advisory Service to assist in developing fundamental proposals, and to take an active part in initiating consequential action.

W. E. JONES

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Introduction

The Conference opened with an Inaugural Dinner on November 7th, at which the principal speakers were The Rt. Hon. Lord St. Oswald, M.C., Parliamentary Secretary (Lords) to the Ministry of Agriculture, Fisheries and Food, and K. S. Bawtree, Esq., Chairman of the National Cattle Breeders' Association. On the first full day four papers were presented and the full texts of these, with summarized versions of the ensuing discussions, are included in this Report. The second day was devoted to the findings of Panels which had been set up by Mr. W. E. Jones earlier in the year to discuss the problems of breeding beef cattle, dairy cattle and sheep. For reasons of space, the Panel Reports have had to be, to a greater or lesser extent, condensed for publication. Discussions on these reports are also included together with the summing up by Dr. Alan Robertson. Copies of the original Panel Reports were distributed at the Conference but additional copies are available from the address below.

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NATIONAL LIVESTOCK BREEDING CONFERENCE
HARROGATE, 7TH, 8TH AND 9TH NOVEMBER, 1962

Speech by Lord St. Oswald, M.C.

*Parliamentary Secretary (Lords) Ministry of
Agriculture, Fisheries and Food*

IT SEEMS to me that this Conference may and should in time come to be regarded as a milestone in the development of livestock breeding in this country. I find the lively and look-ahead attitude of our livestock industry infectious. This attitude accounts for the event itself, and for the impressive support by those who matter.

I ought to say a little about the wise ideas behind this Conference, and how it was organized. It had become increasingly apparent that the science of livestock breeding stood at the threshold of new developments. Methods were available to augment and increase the precision of the respected old rule of thumb. But it had been difficult to keep discussions of the subject free from controversy—controversy so fundamental in character that the directions and even the desirability of progress were questioned. Mr. Emrys Jones and his colleagues in the N.A.A.S. felt, therefore, that the time had been reached for an objective appraisal of the developments that have taken place in recent years, and particularly for exploring the steps that might be taken in future to raise the productivity of British breeds of livestock. This, they felt, should take the form of a National Conference on Livestock Improvement.

They therefore felt it would be advisable to arrange for three symposia to look into the problems and issues involved in the various aspects of livestock improvement, and to present reports to the Conference. These symposia would cover dairy cattle, beef cattle, and sheep. Small groups, consisting of a Chairman, one or two breeders, a geneticist, and a senior N.A.A.S. adviser as convener, were therefore invited to study the problems of each of these classes of livestock. We are all of us deeply indebted to the members of these panels for their ready response to this invitation—this positive challenge—and for the enthusiasm and sheer hard work they have put into their tasks.

We are indebted equally to those other leading authorities in their fields who agreed to give papers on particular aspects of livestock improvement.

The main object of all these efforts has therefore been to foster co-operation within the livestock industry, between pedigree, commercial and artificial breeders; and between scientists and practitioners. Your programme for the next two days is a fair illustration of the kind of co-operation that is practicable and of the results that can be achieved by it. The members of the various panels whose reports you will be considering comprise a fair cross-section of the industry and its advisers, and these meetings of minds will, I feel sure, lead to constructive and penetrating recommendations for the future.

In studying the problems of the sheep and of the beef and dairy cattle industries there is much stimulus for thought in the experience of other sections of the livestock industry. The experience of pig recording and boar progeny and performance testing under the aegis of the Pig Industry Development Authority and other researchers and its illuminating work on carcass dissection, is obviously a sound guide in looking at means of improving beef cattle, in both pedigree and commercial herds, though the breeding cycle is longer.

Perhaps the most striking developments in recent years, however, have been in poultry breeding, and I am most interested to see that Mr. Thornber is to introduce a discussion of the lessons that can be learned from the poultry industry.

The recommendations for sheep recording and progeny testing in the report of the Committee under the chairmanship of Mr. Ivor Morris—whose name I was very glad to see in your programme, as chairman of the session on sheep—and the proposals by the National Sheep Breeders' Association for a Development Body for the industry are now to be considered by a Working Party whose terms of reference have been agreed by all sides of the industry.

Any day now we are expecting firm proposals, agreed by all sides of the beef cattle industry, from the Working Group set up by the National Cattle Breeders' Association to consider the co-ordination of existing work on beef recording and the standardization of methods. I hope that we shall soon see these proposals translated into action. Both these projects involve the setting up of new organizations; both are likely to co-ordinate on a national scale work which is already the subject of pilot or local schemes; for sheep, by the N.A.A.S.; and for cattle by progressive Breed Societies and groups of farmers. Both may prove to be only a starting point for more comprehensive schemes of livestock improvement and development, of a scope comparable to that already being undertaken for the pig industry by its development authority.

With the Common Market holding out new challenges, and export markets calling for proof of performance in our breeding stock, the need today is always for greater efficiency and productivity. There is an immense national investment in the cattle and sheep industries and I feel sure that its richest dividends have yet to be reaped. The meeting of minds on these problems during the next two days will, I am confident, throw a great deal of light on the way ahead.

If this Conference succeeds in dispelling any belief that there are gravely conflicting interests involved in livestock breeding I shall count that a success. If it establishes that there is a single interest, in which scientists and breeders, pedigree and commercial, can unite for future progress, I shall regard that as a triumph.

Speech by K. S. Bawtree

Chairman, National Cattle Breeders' Association

The Times has rightly described this Conference as one of the major agricultural events of the year, and on behalf of all those attending I would warmly congratulate you, Mr. Jones, on your initiative in calling us together. If I refer to subjects outside the scope of the National Cattle Breeders' Association, I would have you know that I have consulted with the leaders of other Breeding Associations but I must emphasize, however, that they must be relieved of all responsibility for my thoughts.

Over the past year or more our industry, as with the whole of British industry, has been concerned with the uncertainties that face this country in the extended—and quite clearly exhausting—negotiations that have been taking place in Brussels. I am aware that this topic of the Common Market might be said by some to be outside our considerations, but I cannot agree with that, as the future of breeders is *entirely* dependent upon the commercial prospects of the progeny of their work. It would, however, be inappropriate to discuss the matter further on this occasion, as it will no doubt be referred to many times during the next two days.

And now to matters that are more within our own control.

We all in the breeding world have been deeply interested in the events in poultry breeding and production, and it is interesting to see among the speakers of this Conference one of Britain's leading authorities on the breeding of hybrid chickens and one who, so I am informed, is experimenting in no mean manner in the production of hybrid sheep.

And now we have the sheep industry clamouring for a Development Board. They have a highly efficient Wool Board that has, without doubt, made a magnificent job of its task. But that deals only, so to speak, with the outside, and a wider mandate may well be desirable: such an approach to the problem would prevent the overlapping of spheres of activities which an additional Board might tend to create.

At any rate these Boards *must not* be permitted to deploy their forces into the field of breeding.

In the cattle world we have a vast and powerful organization in the Milk Marketing Board which, in the field of marketing, has been no less successful than the Wool Board.

It is, as we are, justifiably proud of its work, but for the long-term breeding prospects of cattle in this country I would urge that it is not permitted to dabble *too* deeply in the practice of breeding. And now, I hear within the section of the industry in which I am personally most interested, a murmuring amongst the beef boys for yet *another* Board.

This question of Development Boards, I am aware, Mr. Jones, will be discussed at your Conference but, if we must have these Boards, then let us be sure that they are manned and controlled—I repeat *controlled*—by breeders who, in spite of criticism, have not entirely failed to progress in other fields than poultry.

This Conference will, we trust, bring goodwill and concessions from both sides leading swiftly into constructive planned collaboration. You have been kind enough, Sir, to make reference to our Association's proposals for a National Beef Recording Organization. We are aware of the Minister's interest in this and have been grateful for his encouragement in our work.

My Association also considers it important that the necessary powers are obtained by the Minister to improve the existing basis of bull breeding and in this I hope he will again seek the advice of breeders.

Lastly, but by no means least, as it affects us all in varying and increasing degrees, this vital question of exports of British livestock.

It is nonsense to say that the world no longer needs our stock! True, the potential lies in new markets rather than the old, but whether we enter the Common Market or not it is essential that we venture forth to *sell* our breeding stock with all the *combined* effort we can muster.

Is it insignificant that, within six months of a mission visiting Portugal the Portuguese have increased their purchase of sheep; that we have opened the door to Italy for British breeding cattle; that the U.S.S.R. is, each year, increasing purchases of British stock? These exports to new markets—they are only a small beginning—are bound to influence the future of many British breeders of chicks, of pigs, sheep and cattle.

The new potential for British stock, if really studied, could prove dramatic. It requires effort and, above all, *co-ordinated salesmanship*. In breaking into these new fields throughout the world the closest of joint efforts is essential. If exports are to expand, particularly for bulk orders for commercially priced cattle, the time has perhaps come to form a powerful Producers' (and I emphasize the word Producers') Export Organization to place the potential in its true perspective.

I sincerely hope that breeders and boffins, politicians and administrators will, in their respective spheres, contribute constructively to your Conference. Each has so much to offer: apart they cannot progress, together we will all succeed.

The Dynamics of Livestock Improvement

H. P. DONALD, D.Sc., Ph.D., F.R.S.E.

Director, Animal Breeding Research Organisation, Edinburgh

AS YOU are very well aware, the economic heat is being turned on. We see the results of it already in many directions. Agribusiness grows apace, as does co-operative buying and selling, more investment of capital and less in labour. You know all about this. I think the present ferment is a good thing, and it is right that it should extend to dissatisfaction with the performance of our livestock. We are here because we do not believe that our animals are perfect and we want to consider what can be done about adapting them more closely to our needs.

Animal breeding has little enough to congratulate itself about in respect of its progress in the last twenty years. Is it not fair to say that we are much less conservative in our thinking about crop plants and that we are almost at the stage of expecting new models every year?

Recent figures from the United States show that the output of meat there per man/hour has gone up by 13 per cent since 1948. For milk, it has risen by 42 per cent; and for poultry by 117 per cent. Compare these improvements with the output per man/hour for feed grain which has risen by no less than 168 per cent. The figures in Britain may well be of the same order of size; and you may guess that the increase will have been proportional to the development of greater output on farms by exploiting highly adapted strains of birds and plants.

To expect cattle and sheep to be improved and adapted at the rate possible with poultry is to expect too much. But the example is encouraging. Quite satisfying progress could probably be made in growth rate, efficiency of food utilization and in getting rid of our legacy of fat. In 1930, when pigs used 3·8 lb of food per pound of liveweight gain, Sir Alick Buchanan Smith could be startled by a pig that needed only 3·0 lb. But he would not be startled today. I believe it would be correct to say that average food consumption by pigs has come down by 10 per cent or more in recent years. And there is plenty of scope for further progress. If you consider the efficiency of food utilization in terms of dry matter, existing pigs do little if any better than turn about 15 lb of dry grain into 1 lb of dry meat, including the bones and offals. Since cattle and sheep do not normally enjoy such concentrated diets as do pigs and poultry, there does not seem to be as much information about the economy of food used by them. It will be surprising, however, if it does not turn out that they vary in this respect and that some of the variation is genetic in origin.

Those of us who care to look a little but not much further than the current economic threats, will see the mounting claims of the world's hungry millions to more food. According to Dr. Norman Wright, the world will need to

double its animal production in the next twenty years. Considering the difficulties facing areas of extensive agriculture, I would expect our contribution to the increase to be very substantial. An almost explosive rate of growth will be required and we have to adapt our minds and our institutions to meet this situation.

CHANGES IN ANIMAL BREEDING

Animal breeding today has only a superficial resemblance to animal breeding in 1939. To begin with, a genetic theory has been extended and consolidated and now provides a very comprehensive theoretical background against which to judge the probable results of action or inaction in man-directed evolution of livestock. It is unlikely to be shaken by personal distaste for any of its conclusions. This is not to say that the theory will not be further developed, but the change will increase, not diminish, its power.

Another change is due to developments in nutrition, the arrival of better grasses and cereals, advances in disease control, fertilizer practice, and machines. These advances have radically altered the environments in which our livestock have to perform. Higher average levels of performance are being demanded. And unless a breeder takes the view that stock are already fitted to the new environments as well as to the old, he must think in terms of animals adapted to high performance—high risk enterprises. Ideas on stocking rates, growth rates, and birth rates must be regarded as subject to change, however venerable they may be. Although there is nothing novel in the process of adapting animals and their environments to each other concurrently, such is the speed of technical progress today that the concept is obvious.

Again, market requirements have changed and will change further. We have to reckon, not only with the power of advertising, changes in the habits of shoppers, and in the tastes of people to whom hard physical labour is a rare experience, but also with technical advances in killing, storing, and selling meat.

Finally, techniques old and new are being applied on an ever increasing scale. Outstanding among these of course is A.I. Its direct impact on cattle breeding has been widely felt; but its indirect influence on the development of other techniques may be in the long run no less important. Let me list some of them:

The collection, storage and rapid analysis of vast quantities of records.

Operational research on a big industry.

Deep freezing of semen.

Progeny and performance testing.

We are, in fact, well into a revolution in animal breeding methods, which is merely a part of the technological transformation of the country. It is in the nature of revolutions that someone gets hurt. In this case, it is the producers of breeding stock, and they have sustained a double loss. To all intents and purposes, small scale poultry breeders have been wiped out. Bull breeders have had their business halved. Pig and sheep breeders must be wondering what A.I. and performance testing would do to them. What is of greater general significance is that the collective authority of pedigree breeders has been deeply eroded. We know now a great deal about the size and duration of their operations, and their work has been put to the test.

By this time, nobody harbours the delusion that to pay a breed society subscription is to acquire the secrets of success in animal breeding. To own registered animals gives no guarantee of better than average performance; in fact, not even that. As far as I am aware, no breeder would make any such claims. Nevertheless, breed propaganda does sometimes leave the impression that pedigree breeders collectively assume the social duty of knowing how best to improve our livestock. Personally, I see nothing wrong in this. We are all members of pressure groups of one sort or another. More and more people, however, recognize propaganda when they hear it. And I hope pedigree breeders are pleased rather than disgruntled. It is surely better that we should no longer expect them to have a private knowledge of the future, or to resist successfully the invasion of their domain by science. Let them be glad we recognize that what can be achieved in breeding by the careful study of detail allied to good eye judgment, they do sometimes achieve. The livestock industry has need of them.

Breeders of livestock have plenty of enemies. There are the chemists devising milk and steaks from grass and fibres from plastics; there are the producers in other countries disciplining themselves to lower costs of production; and there are the taxpayers well disposed to cheap food. I do not see any of these people on this programme. But do not be misled. If it turns out that some suggestions are made for the improvement of animal breeding, do not take it for enemy action. Those critics whom, according to the press, you resent so much, are not enemies but friends. They have an interest in your survival.

As a result of the various changes I have spoken of, we find ourselves in the position of having *no* generally accepted authority on the aims of animal breeding. It is up to each breeder to make his own decisions and stand or fall by the consequences. In practice, this means that the majority will do nothing effective and some breeds doubtless will merely drift along, changing little. However, where there is a large scale organized effort in breeding—as with poultry and dairy cows—it is possible to have at least implied agreement about short term objectives among all co-operators.

Members of breed societies could claim to be co-operating in pursuing the same vague ideas. During this Conference, I expect, much of our proceedings will hinge on the question whether these ideals can be made more specific and sharply economic. This is where the absence of an accepted authority will be felt.

CROSSBREEDING

In most discussions about animal breeding, there is a tendency to concentrate on the problem of improving purebred animals. Indeed, I have done so myself throughout this talk. It ought to be pointed out, however, that the performance of crossbreds is economically highly significant, especially in sheep, and—as far as I know—not much is being done to see that we improve our crossbreds. We are in need of proper breed and crossbred comparisons. How does a farmer find out which breed or cross would give the best returns? We have such a wealth of types to choose from, but so little evidence on which to base a choice. For making the best of what we have we need recording and testing, just as we need them for making improvements in the pure breeds that determine the qualities of the crossbreds, and just as we need them for the efficient conduct of livestock husbandry.

We have known for a long time that crossbreeding has great value in improving the meat qualities of the produce of dairy-type animals such as dairy cows and hill ewes. Their own carcass quality leaves something to be desired but they have the great virtues of being numerous, relatively cheap, and good mothers.

It has not been clear what part hybrid vigour plays in the performance of crossbreds. Recent work in the Animal Breeding Research Organization and elsewhere with dairy cattle, pigs and sheep has produced some useful guidance. There is apparently a bonus of perhaps 5-10 per cent accruing to crossbreds in fertility and viability. Milk production and growth rate may profit a little less. Now, although 5-10 per cent may not sound much, if it were all added to the profit margin, it would be worth having.

It is not my function today to regale you with tales from the research laboratories, but I wanted to tell you this much because I hope you will pay particular attention to what the Panel Chairmen have to say on behalf of their groups. Cross breeding, I think, is being applied in too rough and ready a way. Perhaps we should be more enterprising in the places where we use it, and more exacting in the way we match the breeds to be crossed. One of my own favourite ideas is to invade the fortresses of purebred hill sheep, where fertility and vigour are all important. Another I know is shared by Mr. Oscar Colburn, and that is to breed the male and female components of a particular cross in a complementary plan to make sure they combine to produce the desired result. Some breeds of cattle and sheep have, of course, been bred in the past with this object, although in a rather imprecise way. So it will be interesting to learn what future Professor Cooper and his colleagues see in this process.

OBJECTIVES

Presumably, it can be said that there is only one objective for each breed and that is the highest possible economic merit. When we move from this point of agreement to ask what is economic merit and can it be bred for, the disagreements begin immediately. What the various interested parties will say is moderately predictable: the specialists in pedigree breeding, dairy cattle men excepted, may assert that it is to be measured in terms of the prices of breeding stock, and for them this is no doubt true. Commercial farmers say that their income is derived from fertility, milk production and meat, so that the economic merit of an animal lies there. Economists might assert that outputs per acre, per man, and per £100 of capital invested, should be the criteria.

You may conclude that it is possible, but not very likely, that these three statements are merely different ways of saying the same thing. If men breed animals for purely economic reasons, the economists must surely be right in the long run. Sooner or later commercial farmers would be driven to thinking less of production per animal and more of farm production, and adjusting their ideas accordingly on what to pay for breeding stock. What the several Panel Chairmen will have to say about this problem is all important, for without agreement or objectives, discussion of ways and means is futile.

It is not necessary, of course, that everybody working with a particular breed should have the same ideas, provided that, in the constructive phases of breeding, stocks are kept separate. In fact, there is quite a lot to be said for the production of different and competing types within breeds. But if a group

of animals is to be altered by breeding, be it small like a single herd or flock, medium like a numerically weak breed, or large like a numerically strong breed, then it is a matter of common sense to have a clearly understood objective so that it can be sought effectively and continuously by those concerned. The simpler it is the better. Some people take the view that an animal has many important features and that it is necessary to take account of all of them. Before you accept this seemingly reasonable view, I suggest you consider these points. Firstly, are there any good grounds for supposing neglected characters will deteriorate? Secondly, are all characters to be used inherited? Thirdly, would it not be better to improve an important character quickly by concentrating on it? If, in the end, breeders opt for complex specifications we must reconcile ourselves to very slow changes.

Fortunately, it is not likely that all breeders will do so. There are always some who decline to play safe. They will agree broadly with the economist on the need for animals designed to maximize net returns, but will point out that this attitude has to be converted into something more precise and biological when it comes to breeding. What kind of animals should a young breeder aim at? Some humorist once said that predicting is very difficult, especially predicting the future; and this applies to breeders estimating market prospects. There is room here, therefore, for individuals to take different views; to be specific about the kind of animals they are going to strive for. Such men can take strength from the thought that technical advances sometimes make biological handicaps irrelevant. For instance, new drugs for disease control have liberated us from much concern about resistance to worms, footrot and blow-fly in sheep. Our attitudes to wool have already been affected by the invention of man-made fibres. Changes in meat technology could conceivably make nonsense of our carefully nurtured ideas about carcass quality. It has been well said that when men are exploring new territory there is no use demanding that every inch of the way should be known. But a firm sense of direction is imperative.

SELECTION

Assuming that our breeding efforts have some kind of direction, I come now to a consideration of the factors influencing the strength and precision of those efforts. For all practical purposes, the selection of breeding animals is the means by which change is brought about, and there are two main kinds. One is natural selection (that is, by nature), and about it we can do little more than speculate. What effects it has must be reached through infertility and death at some time between conception and breeding age. When you consider the death rates of young pigs, calves and lambs, which often reach 20 per cent, it is obvious that nature gets in first in the process of choosing the parents of the next generation. Nature works in favour of staying alive and in favour of fertility. You may think that is all to the good, but nevertheless you will not hesitate to frustrate her by improving hygiene and reducing the risks of death. Research suggests that no kind of selection, natural or artificial, can alter fertility or mortality very quickly because both have been favoured for generations and both now show very weak evidence of heredity. But you may not be convinced that the last word has been said about this, at any rate in respect of crossbreds or near crossbreds which are being bred in comparatively novel environments.

The other kind of selection is, of course, artificial selection, that is, selection by man. When breeders are exerting their powers of life and death over their breeding animals and their descendants, what considerations influence them? At the risk of a charge of over-simplifying, I will suggest that they are of two kinds, positive and negative. The negative arise from the wish to get rid of any beast that is not paying its way, or not attractive to see or to own. What benefits come of this are immediate. An economic or aesthetic leak is stopped by this culling, but it has little to do with the next generation.

The positive approach concerns itself with choosing the animals, especially males, that are to have disproportionate numbers of offspring. When the majority of farmers set about buying a bull they are free in theory to choose any one of thousands potentially available. In reality, they are like a young man in search of a wife, reduced to making an offer for one out of, say, five or ten young women. Even so, they have to make a choice and they constitute the large and ultimate market for sires, whether or not they use A.I. If the great majority of them decide that the animals they have are good enough, there will be no weight behind the push for better livestock, and nothing much will come of it, but if, on the contrary, many of them keep up a demand for performance-tested animals of greater potential, they will make it worth somebody's time and effort to produce them.

Not being a pollster, I am in no position to say how farmers would answer questions on their breeding policy. But I will risk some speculations for you to consider.

A great many have no real interest in the subject. They will merely buy males that are cheap, healthy, and easy to look at; or they will use A.I.

Some will be conditioned by years of show-going to have show-type animals on their minds.

Some will assume that pedigree breeders are improving the economic merit of animals.

Some will be influenced by what they read and by what they experience in their own flocks and herds to search for animals with evidence of performance to back them.

It seems to me that it is this fourth group which provides the motive force behind a movement for better livestock. They are the real supporters of progressive efforts by the big organizations like the Pig Industry Development Authority and the Milk Marketing Board and by individual breeders. And perhaps the most effective action in speeding the tempo of improvement would then be to enlarge this class. It might pay to encourage the National Agricultural Advisory Service to increase their efforts in this direction. The fact that this Conference has been conceived and organized by the National Agricultural Advisory Service is highly significant and I hope we will not be premature if we congratulate ourselves about it. The Agricultural Press has also a powerful influence and does a fine job of chronicling research and development, and creating an awareness of the possibilities of change. It has probably had a good deal to do with the present size of this fourth group.

SUMMARY

In pursuance of my task of outlining the problems, I would like now to summarize the broad outlines as I see them. Out of consideration for sheep and beef cattle men, I will use dairy cattle for illustration.

Herd owners are subjected to a variety of pressures. These include the influence of shrinking economic margins. But several other forces are at work, the effects of which may be to divert some effort away from the goal of maximum economic merit. They include pedigree breeding, herd selection panels, the press, the Ministry's licensing, and the Shows, whenever they are irrelevant or pursuing other objects. The net effect of all these forces may be very small. Beyond the mass of herd owners, the M.M.B. uses a variety of techniques in its search for improvements. Pedigree breeders, or rather a fraction of them, pursue a variety of objectives. In the main they are without technical aids although this is not altogether true, since some dairy cattle breeders use recording, progeny testing, and even importation.

What can we do to improve the situation? We could try to get rid of some of the diversionary forces although this would be difficult and perhaps not worth the great trouble it would cause. It might be better to strengthen the progressive forces. There are two ways that I would like to put up for your consideration; the Panel Chairmen have ideas, too.

One is to use the great strength of the National Agricultural Advisory Service. What body is better able to appreciate the significance of the economic pressures on us and to explain to farmers how to prepare to meet them by recording and insisting on evidence of performance in stock they buy?

The other way is to make available to constructive breeders *all* the modern tools they need for carrying out their work. They should have ready access to:

1. artificial insemination,
2. imported stock,
3. research results,
4. recording and testing machinery, and by no means least,
5. discussion with like-minded breeders.

The great handicap of the individual breeder is the small scale of his operations, but there is no need for him to suffer the added handicap of working without modern methods. If those who feel that they could use these tools would join together regardless of type of stock, they could gather strength from each other and organize the kinds of technical help they want.

I do not think that we should leave everything to the Milk Marketing Board. Certainly, in dairy cattle breeding, it is a powerful agency for improvement, but it has its limitations. To the extent that it is dependent on popular support, it cannot take risks or work on hunches. Since Dr. Edwards is here to correct me if I am wrong, I will venture the opinion that it is not easy for the Board to follow a diversity of policies in the hope that one of them may be just right; or to breed locally adapted races. In contrast, individual breeders are free to breed any way they like. The rest of us can watch hopefully while they seek success and then without a worry declare all of them redundant if they fail!

So, as a comparatively short-term ambition, I visualize a little trimming of negative influences, but the main changes will arise from the good principle of emphasizing the positive. The National Agricultural Advisory Service is putting its shoulder to the task, the Shows are developing their forward look, the Milk Marketing Board is growing stronger, and the constructive breeder getting more technical help. I know he is, here and there, applying some self-help now, but I would like to see it extended. This appreciation of the position will, I hope, be of help to you when you come to consider the proposals of subsequent speakers.

Perhaps it is not going too far to say that not for 100 years has there been a time of such opportunity in animal breeding as there is now. The industrial revolution and the enclosures created new markets, and encouraged new husbandry practices. The men of those times seized the chance to develop most of the breeds we have today. History is now repeating itself. Another revolution is upon us. The question is: are we capable of taking our chances to meet the needs of the times?

Discussion on Dr. Donald's Paper

MR. B. SHAW: As a general farmer I find it difficult to get information about the activities of the people at Edinburgh. Although one can find out what is happening at the National Institute of Agricultural Engineering or the National Institute of Agricultural Botany there is nothing that I am aware of that livestock breeders can do, and I suggest that something should be arranged on these lines.

CHAIRMAN: Thank you very much for the suggestion.

MR. A. TRAVERS LEGGE: (*Oxfordshire*). Would Dr. Donald care to comment on bull licensing?

DR. DONALD: Bull licensing is one of my favourite after dinner topics but I don't regard it as a matter for serious consideration at a conference like this. There was a time when I used to campaign against it, but now I am in favour of retaining it as being a first-class joke.

MR. G. P. HUMPHREYS-DAVIES: Does Dr. Donald think that bull licensing, as such, should be abolished or does he want it retained in some different form?

CHAIRMAN: The questioner is a Deputy Secretary at the Ministry of Agriculture and I am pleased he is here to note any comments on this point because he will have a big influence on any decision that is made.

DR. DONALD: The greatest impact on the quality of the cattle population in this country is made by the significant breeding herds. The influence comes from above and not from below and the effect of bull licensing is simply to remove some animals from the bottom layer. Now, even if this removal were effective, even if it were possible to look at a bull and predict what his progeny were going to be, just removing it at that level would not achieve very much anyway.

CHAIRMAN: Do you want to retain it in some other form?

DR. DONALD: No, I see no reason for it at all.

MR. G. SYKES: Dr. Donald made a serious omission in his comment on constructive breeding in that he did not bring up the question of the business

structure. We find that in some parts of the agricultural industry vast quantities of capital have been spent and it is obvious that there will be enormous scope if the market can be internationalized.

DR. DONALD: I had better make two points clear; first of all, I want to avoid treading on the ground that is to be covered later in the Conference, and secondly, I don't undertake to solve all the problems of the animal production industry in the space of a few minutes. However, I would say that I visualize a constructive breeder as being someone who wants to do something. That is to say, he is self appointed, a man who has set himself a target that is different from the average performance of a particular breed. I would not regard the man who wanted to produce an average type of dairy cow, or sheep, or what have you, as a constructive breeder. He must have an objective and his methods must be related to the attainment of that objective. If he is going to do something difficult that requires recording, then he must record, otherwise we won't accept him as a constructive breeder. If he is a man who says "I want to change the shape of animals" then he can do this very well by eye, and all I would require of him is that he do it effectively and can show that his objective is realistic. Now the industry as a whole has no obligation to make this profitable to him. My reading of the report of the Panel suggests that they assume that, somehow or other, the industry has an obligation to keep pedigree breeders in business. If this obligation is accepted we should know just exactly what it is that we are accepting and what it is going to cost us. If it is not accepted then I think we should clear our minds of any assumption that somehow or other arrangements have to be made so that constructive breeders can be well paid before they have really achieved anything or, indeed, after they have. This is the fundamental problem; the position varies with different classes of livestock, but we are in the middle of a revolution and if anybody does not like the way the revolution is going then he must do something about it firmly and definitely before it goes very much further.

COLONEL D. KENNEDY: (*Shropshire*). May we have a chance later to ask Dr. Donald questions about the work at Edinburgh and the dissemination of results from the research establishments?

CHAIRMAN: I think we ought to deal with this one now since Dr. Donald is not likely to appear on the stage again.

COLONEL KENNEDY: As I understand the position there are very large numbers of animals kept on various farms at public expense in different parts of England and Scotland, but I am very hazy as to how the results of these experiments are disseminated to the farmers of this country. My impression is that the whole activity was pure research with no commercial implications.

DR. DONALD: The Animal Breeding Research Organization has been established to carry out fundamental research on animal breeding problems. It works with other bodies, such as the agricultural colleges and the National Agricultural Advisory Service, that are charged with carrying the results of research to farmers. Animal Breeding research is going on all over the world and the result of this does not become public except through the medium of the advisory services or through such meetings as this. We publish our work in the recognized places and it is available there for the advisory services to use. Indeed, they do use it. I will admit, however, that there is at the moment

no popular publication, but we are trying to produce one which will go some way, I hope, to satisfy the interest which some of you have in the details of our activities. I must point out, however, that what we say is not confined entirely to what we do ourselves. We are part of a very large world-wide arrangement for conducting research on the fundamentals of genetics, and what I am talking about today is not only the work I have done myself but relates to work which has been done in very many countries of the world.

CHAIRMAN: I think Col. Kennedy has a legitimate complaint here and it has concerned me a good deal during the last twelve months. I think that, as far as England and Wales are concerned, the National Agricultural Advisory Service has got to improve its liaison with ABRO and other research establishments and we are, in fact, at the moment working out plans to this end. A duty does fall on us to take up this point and try to improve the flow of information from the research establishments.

MR. BUTLER: Referring to Mr. Shaw's question, which also links up with Colonel Kennedy's point, I would remind the Conference that the British Cattle Breeders' Club was set up to try to bridge the gap between the research worker and the breeder, and furthermore if Mr. Shaw wishes to make a more scientific approach he can join the Society of Animal Production. But I would like to ask Dr. Donald if he does not think that the Ministry made a mistake during the war in trying to encourage everybody to join breed societies. This is, perhaps, an unorthodox view, but I would like to know what Dr. Donald thinks about the suggestion that we have too many so-called pedigree breeders. We really want a small nucleus of breeders who are working on pedigree improvement and the breed societies have too many members to take any active part in this work. I cannot help feeling that if the crossing of breeds for commercial milk production had been advocated we should be very much better off than we are today.

DR. DONALD: I don't remember what policy the advisory services followed during the war on this matter but it would seem to make very little difference if a man who was carrying out cross breeding badly were to join a breed society. I very much doubt whether he would make a very good pedigree breeder if he was a bad cross breeder.

DR. T. R. PRESTON: (*Aberdeen*). I would like Dr. Donald's comment on one general point. Most European countries concentrate on one type of cattle for producing both meat and milk whereas in this country we have specialized breeds for these two purposes.

DR. DONALD: I would prefer to leave this to the Chairman of the Dairy Panel.

MR. THATCHER: It seems to me that many people who express an opinion on the condition of our dairy cattle at present have not been familiar with the progress that has been made in the last twenty years, and I would certainly not agree with the suggestion of devoting one's interest to cross breeding. Let us accept the fact that progress has been made largely through pedigree breeding and that many of the breeders, even though they are in a small way, are still achieving something.

MR. AUSTIN JENKINS: I was reported in the press a short time ago as saying "It is high time that the battle between the geneticists and the breeders stopped;

both have something to contribute". Some four or five years ago when I was President of the British Society of Animal Production I made an appeal to the geneticists that they should cease criticizing the breeders until they can prove that they can breed better stock. They do not realize that the practical experience of generations behind the breeders can serve a very great purpose if the two sides will link up.

I would like to add how pleased I am that Mr. W. E. Jones has called this Conference together because out of it I believe we shall see the geneticists and the breeders growing closer together.

CHAIRMAN: I think we will finish on that salutary note and I am sure you will want me to thank Dr. Donald very sincerely for a paper to which he has given a lot of thought.

Following the remarks about the lack of information on the results of animal breeding research Mr. J. P. Maule, Director of the Commonwealth Bureau of Animal Breeding and Genetics, drew attention to the work of the Bureau and it was arranged to distribute a descriptive leaflet with the Report of the Conference.

Lessons from the Poultry Industry

CYRIL THORNBER

Director, Thornber's Ltd., Mytholmroyd, York

ONE of my earliest jobs in the poultry industry was as a stock inspector employed by my father. In those days we used to produce between 2½ and 3 million chicks a year, our hatching eggs coming to Mytholmroyd from 100 supply farms concentrated in Yorkshire and Lancashire.

Among my tasks was that of ensuring that there was adequate stock on these farms to meet the estimated demand for chicks. In terms of quantity this was quite easy. But in terms of quality, the problem was much more difficult. Each of the 100 breeders ran his own breeding programme as he thought inclined.

For instance, two farmers, perhaps even in the same parish, would mate White Leghorn cockerels with Rhode Island Red pullets. The resulting chicks looked much the same but there the similarity ended. Genetically, the chicks were completely different. In other words, buying chicks from us—and from anyone else at that time for that matter—was something like a lucky dip.

One year a customer would swear *by* our chicks because they had done everything expected of them. Twelve months later, the same customer would just as likely swear *at* the chicks, because they were not a patch on those of the previous season. Of course, the answer was simple. The chicks had originated from two different farms and two different breeding programmes.

In fact, there was just no consistency in the product we were selling.

Another big problem of the poultry industry in the 1930's was bacillary white diarrhoea—B.W.D. This disease is transmitted through the egg and the usual means of eradication is to blood test all birds and cull the reactors.

We discovered that certain flocks had no reactors. So it was not a difficult job separately hatching pure-bred eggs from these flocks and using the resulting chicks for repopulating those flocks where the incidence of reactors was high. As a result, these flocks soon also became trouble-free.

Unfortunately, by getting rid of one problem we introduced another. By pure chance, one of the supply flocks which had had such a good B.W.D. record was very slow feathering. Not only did we transfer the good B.W.D. record to the other flocks but also the bad feathering. It was then that we realized that if we could accidentally influence genetical changes from a negative standpoint, surely we could design a breeding programme to make positive changes genetically.

However, this proved more difficult than we thought, for instead of concentrating all our production into just two types of chicken as we do today, we actually used to produce no fewer than seventeen different types of chicken. There were Rhode Island Reds, White Wyandottes, Light Sussex, Black, White and Exchequer Leghorns, Anconas and a host of crosses. It was a formidable list and of course, over a total production of two million, the numbers of any one type were never great enough to allow much scope for selection.

Moreover, there was little opportunity for a consistent breeding programme. One year the Black Leghorn x Rhode would prove to be the most popular chicken. And if we dared pay attention in those days to consumer research—such as it was—and increase the production of this particular cross, the following season we were sure to find that it had gone out of fashion and been replaced by, say, the White Leghorn x Rhode.

There was nothing logical about the change in demand. If a supply farmer producing a certain cross happened to be good then he unwittingly helped to set the fashion for next year. And of course if he happened to be bad, then he unwittingly killed the fashion. It was as simple as that.

There was a lot of talk in those days about the Ministry of Agriculture's new scheme to upgrade hatchery standards. A Government report on the poultry industry showed that mortality at laying trials had increased in ten years from 7 to 20 per cent. Mortality on the farm ranged from 4·2 to 32 per cent.

My father supported the report. He believed that while the standard of management on farms was not always of the best, the hatcheries themselves were not entirely without blame. While some hatcheries had continually used their best endeavours to ensure good stock, often at considerable expense to themselves—others had been driven by the desire to make quick profits.

The Ministry report was the fore-runner of the present accredited scheme. But I must confess that, although I shared my father's enthusiasm for its good intentions, I could not always see eye to eye with the way in which it was implemented.

For instance, Rhode Island Reds that were rejected in Lancashire by the Ministry as being unsuitable for breeding, simply because of their dark underfeather, proved to be quite acceptable to Ministry officials in Yorkshire. And mark you, birds were rejected on this score whether or not they were to be used for pure breeding or merely for crossing.

Moreover, Ministry officials were always keen on a big bird, presumably in the belief that a good big 'un will always beat a good little 'un.

I could never understand the Ministry's insistence on minimum egg size. Breeders were not allowed to set any egg weighing under 2 oz even though it is—and was—a well-known fact that as any pullet grows older, its eggs grow larger.

Then there was that old score of pullet breeding. The Ministry insisted on breeders breeding pures from second-year hens only, even though this naturally halved the rate of progress. The argument was that it took eighteen months to discover whether a bird was a good layer.

Moreover, I could never understand the logic of using first-year cockerels (as breeders were allowed to do) on second-year hens. If it was necessary to test one half of the mating, then I thought it should be equally necessary to test the other half.

But then in those days I was much younger. And it could be that I was much more foolish. Whatever the explanation, I became very confused about what was expected of us. After my father died, we decided to embark on a breeding programme of our own. We worked out a new blue-print for producing commercial day-olds and decided that the fewer factors that we bred the better chance there would be of making progress.

We also decided not to select for any factor unless it affected the income or profit of a bird. We drew up a simplified breeding programme—on reflection,

perhaps too simplified—in which we selected birds merely on the basis of egg production, body weight and liveability. Feather colour, for example, did not worry us at all.

The next problem was getting hold of basic strains to test. Obviously we wanted nothing but material from closed flocks, but it was amazing just how difficult closed flocks were to find. The definition of the term could not have been widely understood at that time, for breeders would claim to have a closed flock even though they bought in new stock cockerels each year. "But we never buy females" they would answer in defence of their claim.

To obtain enough material, we had to buy flocks like these and close them ourselves for several years before we were able to test them.

It is vital to start with as many strains as possible because each one has both strengths and weaknesses for desirable characteristics. These can be discovered only by accurate recording and progeny testing over two or three generations.

Having established the relative values of the pure strains, the next step was to test cross-matings of these strains. When pure strains are cross-mated, the combination of their genes often results in a boost in performance, giving a progeny far superior to their parents. Unfortunately, there is no easy way of forecasting which strains will produce superior progeny when combined together. The only solution is to test various possible combinations.

We started testing crosses on the farms of customers who were willing to co-operate with us by keeping records. This is a system we have never changed, for we have always believed that the success or failure of any breeding programme is whether the progeny perform well not on our farms but on those of our customers. Any breeder should make sure that the chickens he produces are capable of performing well under a variety of systems both of management and housing.

As may be guessed, the breeding research involved in producing and improving strains is today very complex. Three main breeding systems are employed, closed flock selection, inbreeding and recurrent reciprocal selection. At various times experiments have been set up to show the relative merits of these three systems. The result is so very dependent on the base material and the characters being selected that such experiments serve little purpose. In a large programme it is possible to try all systems in different situations.

In 1958, we realized that we were getting a bit out of our depth. Up to then all our selection work had been done by people like myself, with no qualification as geneticists other than an inherent desire to accept a challenge and improve the quality of our product.

The problem was resolved in two ways: we progressed from an immediate start of eight male breeding pens to 1800 and we started to employ qualified research staff.

I well remember my first encounter with Dr. Alan Robertson, when he subjected me to violent criticism because of my failure to employ qualified people to assist with our breeding work. I was aware that this criticism was perhaps justified but I had to defend my position and I told Dr. Robertson that the blame was his not mine, for there just weren't any qualified people to be had.

Of course, as always, the geneticist had the last word. If I would make known my need, Dr. Robertson said, people like himself would see that it was

filled. And he did. A few months later, he sent us our first geneticist. This newcomer was soon joined by another, and today we have a research staff investigating breeding and allied problems.

Research is the backbone of any progressive breeding programme today, and we now spend more than £150,000 a year on upgrading our stock. Geneticists, statisticians, physiologists, haematologists and veterinarians are all employed to "blueprint" our commercial chicken.

But this strength of research staff has not been accomplished without some difficulty. For a commercial concern to employ scientific staff was something almost unheard of in those days in this country. We had to convince graduates that they would have ample scope and freedom for research without too much control from the commercial aspect.

Another fear of research workers was that if they joined us they would divorce themselves from scientific colleagues working in independent research establishments who would be reluctant to discuss problems, in case the findings would be commercialized.

The problem became more acute as more and more people were employed by commercial organizations. Eventually, an effort was made in this very town to form an organization known as the Poultry Breeders Round Table. This had the object of bridging the gap between scientific workers in universities and government and those in commercial organizations.

It is very gratifying to report that, after three years, this bridge has been well and truly constructed. The Round Table has proved more successful than we had at one time dared hope. Each year we have well over one hundred present at our meeting, where we can get to know each other better and discuss common problems.

As a result of the change, we are now able to engage in research at Mytholmroyd that would have been impossible six to eight years ago. But at the same time, it always gives me a kick to remember that, although I failed what we used to call the "school cert". before the war, I chair our research meetings and can frequently call to order scientists with qualifications as long as my arm.

What originally started off as an attempt to standardize the genetic make-up of the stock we were selling soon broadened itself into studies of other factors which affect performance as a whole. For instance, we soon became involved in the field of veterinary research. The future control now appears to lie in preventing disease rather than curing it.

The failure of the slaughter policy to eliminate fowl pest and an acceptance of vaccination as a means of control could easily be followed by similar approaches to many other diseases.

Another aspect of our work in which we were soon involved was assessing the various traits of the breeding programme and analyzing the mass of figures and facts which we were accumulating. As we have 200,000 birds regularly on tests and as we record not only egg production but seven other traits it can be seen what an enormous quantity of figures we collect each year. There became a need for a method of dealing rapidly with this accumulation which was impossible by straightforward arithmetic and slide rule.

Our means of analysing results had graduated through the slide rule to the desk calculating machine and now through the punch-card system to the electronic computer. Buying a computer means engaging specialist staff to operate it but its value lies in its ability to handle data at very high speed. Breeding selection is dependent on a very tight timetable; the quicker you can calculate

the results the quicker you can select the right type of bird to make progress.

The stock multiplication involved in producing a four-way cross means that in three generations we can increase the number of birds from 1,331 to 46,800,000. Moreover, the end product is far more standardized than it was ten or twelve years ago.

Nevertheless, we are still only at the beginning of what can be done. If we are frank with ourselves, we must admit that progress has been primarily successful in not so much upgrading the best birds but in reducing the number of bad performers and getting more birds into the medium and better performing groups. Proof of this is easily obtained in the field, for it is not so long since one of the most important yardsticks of a poultryman was his ability to cull. He did this so that he could reduce his feed bill without upsetting his revenue. But today, I cannot think of any instances where farmers resort to recording in order to cull "passengers".

But while it is possible to standardize good qualities in quantity, multiplication also increases the danger of error. There are a number of places where human error can crop up—an egg may be marked wrongly or a wing-band lost.

For this reason, we employ blood typing staff who check every bird to ensure that its pedigree is as stated in the records. We have been able to correct sufficient errors during the past year or two to give us the added confidence of knowing that the chicks we sell are exactly as our geneticists intended.

It is always interesting to look back and compare the way we have approached any problem with the way we would do it had we the opportunity to travel the same road again. If we could start again, I think we would begin relating genetics to environment much earlier. It is a very complex relationship but I believe in the past we may have paid too much attention to genetics, and not given enough importance to the effects of environment and husbandry on performance.

This is a conference primarily for discussing livestock improvement in larger animals. We have achieved some publicity in the press because of our growing interest in sheep breeding. The publicity has not been sought, for these are early days and whether or not we will be successful will be better judged in five or six years time.

We first became interested in sheep breeding when we read the Morris Report on sheep. Substitute the word poultry for sheep in the report and you get the feeling of having been through it all before! Sheep breeding fitted in with our other activities because the increasing trend to house poultry intensively meant we had those extra acres of grassland on our hands.

All we are trying to do is to utilize the variation that species give us by extending to sheep the same breeding principles that have been successful with poultry.

We hope we will succeed and hope, may I say in conclusion, coupled with luck and an ability for accepting things going wrong, is one of the major qualifications needed by any breeder at the present time.

Discussion on Mr. Thornber's Paper

MR. G. SYKES: I would like to ask a question similar to the one I put to Dr. Donald. Poultry breeding, especially the business structure, is moving into the international sphere. There have been very dynamic changes in the last four years and I would like Mr. Thornber to comment on them.

MR. THORNBER: Perhaps I could recount some of my impressions of various visits to America. When I first went over in 1950 there were a few large breeding organizations becoming established and I speculated that perhaps in thirty or forty years the egg side of the poultry industry would be covered by about ten major breeders. It has been reduced to less than ten in less than ten years. These people don't just sell in America; they sell, as you rightly say, internationally. Whether or not the chickens are any better remains to be seen but certainly to run a large research organization you must have high output and I know of many organizations even on the egg production side that are producing in excess of 100 million chicks per year. It is regrettable that this process of evolution means that some people will have to go out of business but I can't see that it can be stopped. You must have improvements in whatever product you are dealing with and this improvement will primarily come about through research. The bigger organizations with the facilities and the money are able to make more progress than the smaller person. In the future fewer people with larger research teams will breed the stock we need. Even now you can count on one hand the organizations who are producing about 75 per cent of the chickens, whether for broilers or egg production, used in this country each year.

PROFESSOR COOPER: (*Newcastle*). Is Mr. Thornber at the point where he can check his objectives for sheep breeding and define those objectives. He spoke of simplification of objectives in poultry breeding; can he give a corresponding statement for sheep?

MR. THORNBER: We accept that heterosis is something worth going for so, in actual fact, we are aiming at crossing but we have got our objectives down to two points, gross weight and carcass quality.

MR. CRAWLEY: (*Hampshire*). References have been made to a certain development authority that over the last few years has spent about £2 million largely on breeding research and I would like to ask Mr. Thornber whether it is possible for a central authority of this kind ever to undertake breeding research work. I can't help feeling that the whole secret of the success of such work is that there must be a leader and that there must be a target. I cannot see that any central organization is ever going to have the enthusiasm and zeal to be able to go forward progressively with such work. Linked with this we heard in Dr. Donald's paper of the right of the pedigree breeder to subsidization. Many of us commercial breeders feel that this is completely and utterly wrong. The pedigree breeder wishes to have his stock tested and recorded because he in turn wishes to sell it for a higher sum of money. If this is sound policy he ought to be able to afford to do this research and recording himself. If it is not sound the industry should not be saddled with an expensive and cumbersome system. Do you feel that a central authority of this sort can ever take the place of the private individual working for a profit?

MR. THORNBER: To speak sincerely the answer must be "Yes". The question is whether in practice it will work. We have had many claims made in the poultry industry in recent years that the salvation of the smaller breeder is to combine with neighbours to pool their resources and knowledge and, as a group, compete to produce the better product. In theory this is fine; in practice it is difficult as far as poultry are concerned. The traditional poultry breeder is a very strong individualist with fixed ideas which he expresses quite freely. Trying to tie him in with other people will undoubtedly lead to disunity.

If you say that this thing is to be run by a team I couldn't agree more. One certainly needs to get some team spirit amongst the people concerned but this is not necessarily always easy. We often claim in our own organization that doing the job is simple; the snag is in persuading people and to get them all pulling in one direction. I class myself as a cheer leader trying to get the team to work together with a common objective. At times we agree and at times we disagree but we certainly have team spirit and we have got respect for one another. Having got that we do get into some violent arguments but we can still leave the meeting and be friends with one another. The two essential things, I think, are an element of profit, and secondly, and perhaps more important than profit, an intense desire to do a certain job, in this case breeding.

MR. H. MCFADZEAN: (*Wiltshire*). Could I ask Mr. Thornber what degree of inbreeding he uses in his parent stocks and, if he uses any inbreeding, what are the snags in establishing his various lines.

MR. THORNBER: I could answer it correctly and quickly by saying that as far as the parent stocks are concerned there is no inbreeding, but I don't think that is what the questioner means. He means what degree of inbreeding is there in the basic materials. The answer is from about nil up to about 80 per cent. You take your choice depending upon the strain. In general terms, our experience is that whatever breeding programme you have in mind, after a period of time, it becomes very difficult to avoid inbreeding. As your selection progresses you find that you are going through quite severe bottle-necks in so far as families are concerned, and after this the degree of inbreeding does tend to climb. From a personal point of view I am not afraid of inbreeding. I think the usual things will happen depending upon how close you go with inbreeding. Taking the extreme inbred material, the chickens from Reaseheath, there is still a degree of variability in them. You cannot generalize; some strains stand up better than others. Undoubtedly you go through a trough with close inbreeding in the third, fourth and fifth generations. If you can get through that stage with some birds still alive you have a fair chance you will maintain your line. They are no good as parent stock because you don't get enough production from them but they can be extremely useful. If we need to use inbreeding to produce a superior kind of product we do so and, very broadly speaking, in most of your selection techniques as you go through several generations of birds you find that certain individuals become the basis of the line and it is very difficult to get away from them.

MR. B. MATTHEWS: I would like to refer to the question that Mr. Sykes raised earlier on integrated organizations. We have seen in this country recently that one of the largest chicken processing and marketing companies has acquired an interest in the broiler chicken breeding business. I would like to

ask Mr. Thornber whether he sees this as a thing of the future and how he would tackle it should it arise on a far greater scale than at the present time.

MR. THORNBER: It is not an easy question to answer but I will trace it back through my own experience. I started with an interest in the hatchery side of the business; because of the problems I became interested in breeding; because of being interested in breeding we found ourselves with a research organization and so on. Inevitably the business grows and even though our organization was relatively small it was impossible to run it as a private limited company. If you have an integrated organization concerned with other aspects of production, as we have in the poultry industry, at least you must admit that whoever is at the top is in a position to control policy over the whole field. Whether he puts the right things into operation is something that time alone will tell. It could be, and this is merely speculation on my part, that possibly in or through big business organizations there may be too much emphasis on profit and not enough emphasis and interest in doing the job. I don't know.

CHAIRMAN: Well, with this emphasis on profit I would like to thank Mr. Thornber on behalf of all of us here and close the session.

Cattle Improvement Programming in Operation

J. EDWARDS, C.B.E., D.Sc.

Chief of Production Division and Scientific Adviser, Milk Marketing Board

WHETHER they know it or not, the organizers of this Conference chose a most interesting date (for cattle breeding) when they fixed it. It is exactly twenty-one years since my colleague, the late Dr. A. Walton, and I submitted a memorandum to the Agricultural Improvement Council arguing the case for A.I. in Great Britain, and twenty years to the month since, as a result, we took the first 'phone call for an insemination at the newly created Cambridge and District Cattle Breeding Society. Since then 15 million cattle have been bred by A.I., which is four times the number of breeding females in England and Wales.

Mr. Tom Lasater (of Beefmaster fame) has said that any bull stud will remake a cow herd in its own likeness in three generations. On a national scale the A.I. bull stud is well on its way to accomplishing this with a revolutionary effect that has been seen in the making over the countryside in the past two decades.

I propose in this talk to pinpoint the main achievements of the past twenty years as I see them and to describe our objectives and hopes for the future. I do not expect total agreement with what I have to say but I ask those who may disagree to accept that all of us engaged in the direction of our breeding operations—Board, Executive and A.I. Committees—believe them to be founded on the best evidence available to us. In an age in which science and technology are revolutionizing our way of life, I am sure the cattle breeding industry has no wish to step out of the main stream. We are in it now, giving a lead which others envy and are attempting to follow, and provided we continue to maintain a good blend of experimentation and the commercial exploitation of the results, we can stay in it with further gains to come in the economic production of milk and meat.

I shall deal first with milk because it was to improve the inheritance of our cattle for this that we advocated the introduction of A.I. The challenge of the small size of the dairy herd to livestock improvement was a main section of the 1941 memorandum I have referred to and at this time 100,000 out of our 150,000 milk selling herds were in the size group 1—15 cows. Great numbers used a neighbour's bull and few could afford even a good untested young bull. The ownership of a progeny tested bull was quite out of the question. Even among breeder herds there were few owners following the progeny testing methods of the early pioneers and the use and sale of untested sires was the rule.

Routine progeny testing came late on the scene in our country. An attempt to make it part of the milk recording service in the 'Thirties' did not come off, although from the turn of the century it had been an integral part of recording

and dairy cattle breeding in such countries as Holland and Denmark. A leap forward came with the Board's involvement in A.I. in 1944 and the creation of the Bureau of Records in the following year. A complete service of records, including progeny tests, was organized for all—the A.I. movement, breed associations and private breeders.

This was undoubtedly a landmark but it was only a beginning. For the first time records for the proper study of inheritance began to accumulate in massive volume to give scope for much-needed research into heredity/environment relationships and, more specifically, the meaning of progeny tests and the interpretation of ancestor influence in a pedigree, e.g., the contribution discernable for dam, sire and grand-parents.

Fascinating and important as research into general topics such as environment/heredity interactions and the structure of breed populations might be (and I shall return to this later), those engaged in the selection of breeding stock for the rapidly growing A.I. movement were in no doubt about their top priorities. These were: the interpretation of progeny tests of old sires and the selection of young sires.

Most of you know the outcome and so I will deal with it briefly. For tested sires we have come to accept the Contemporary Comparison method of interpreting breeding merit for milk as the best available to us, a conclusion being come to in other dairying countries. The relative breeding value of a sire, as revealed in a wide scatter of herds representative of the range of commercial conditions of production, is sound. Superior genetic merit stands out at high, medium and low levels of management and is real. Estimates of the merit made on first lactation performance are substantiated by later performance and this is shown not only in subsequent lactation yields but by the culling rate as practised in many herds by many owners.

Here I shall describe only the culling evidence which is measured by finding the proportion of a sire's daughters entering the herd which are still in production at the end of the time needed to complete three lactations. For sires with a heifer C.C. rating of 50 gallons or better we find that 66 per cent of their daughters are still around at this stage (third lactation), whereas for those with a rating of -50 gallons or worse the proportion is 52 per cent. We have evidence of the same kind extending to give completed lactations for two sires of very different ability. For one, increasing yield by +151 gallons, more than half of the progeny were still going strong at about nine years of age (five completed lactations); the other, reducing yield by -74 gallons, was represented by only 22 per cent of his daughters.

To be satisfied that we have found a method of assessing sires for superior genetic merit, that this merit can be discovered and exploited at different levels of feeding and management and that it is linked to replacement rates, is of great importance to our breeding programme. Superior genetic merit means lower costs of production in the milking herd—more milk produced with little or no increase in overheads and more cows living to reach mature yields: costs are further reduced by the need for fewer replacements. Naturally, also, the lower replacement the rate the larger is the proportion of the national dairy herd that can safely be used for breeding for beef while producing milk.

I think this is a good point at which to take the opportunity to scotch—I hope once and for all—the idea that in our programming we are breeding only for high and ever higher yields of milk, completely blinded by or immersed in statistics. Quite apart from the important part played by our

national panel inspection system in assessing conformation, which I regard as second to none in the world and about which I shall speak in a moment, nothing could be further from the facts. The method used to select sires for A.I. breeding—the C.C. index—is derived in a wide environmental field. As a measure of genetic merit it possesses some of the attributes of the processes of selection in Nature affecting survival values, adaptability and the will to live and thrive. As such it avoids the pitfalls and dangers of selection in single herds and the use of *absolute* yields sometimes produced by a skill, a kind of management and a scale of feeding that are utterly different from the commercial conditions of production and frequently non-repeatable.

PANEL INSPECTIONS

I think the place of panel inspections in our programme is now widely understood. Normally panel members—390 in number—are elected members of our A.I. Committees, though some are co-opted. By far their most important task is the assessment of the kind of stock being bred by our A.I. sires. In the early years young stock were inspected but this was found to be unrewarding and now inspections take place at the in-milk heifer stage and again on the mature daughters. Annually approximately 3,000 daughters of 135 bulls are inspected on 1,500 farms. This work is done entirely voluntarily and speaks volumes for the enthusiasm permeating the panel system. I do not know of a more comprehensive system of progeny inspection anywhere.

Sire progeny groups are assessed for seven attributes:

- Dairy temperament;
- Milking characteristics;
- Udder;
- Teats;
- Legs and feet;
- Body;
- General appearance;

which have commercial and survival value. Others may be added as time passes and panels for some breeds may be particularly interested in size and meat or muscle development. On-the-farm inspections have been the practice until this year, when the September Great Yorkshire Show here at Harrogate gave the opportunity to try the inspection of sire groups brought to one place. There were eight progeny groups of Friesian bulls in the Northern Region comprising 128 heifers and they were judged by four Northern panels working independently. Although designed as a test of a system of judging—was it better than on-the-farm inspections?—it provided also striking evidence of the uniformity of work done by panels. At a discussion following the trial, at which our twenty-three centres were represented, the conclusions were reached that on-the-farm inspections should continue and that, regionally, group judging of progeny should be developed as an exhibition likely to be of great interest and information to the membership.

Increasingly our A.I. Centre Committees—four to five in each of five regions—are working together towards regional standards and this has advantages in the genetic field in addition to the more immediate ones of the acceptance of inspection reports and the exchange of sires between centres. It also has

the great merit of decentralization in programming, avoiding "bigness". When the process is complete one can foresee in each region a striking and very practical event in the annual breeding calendar: a regional show of progeny groups of all young sires on test; their assessment by panels; the marrying of this to their newly-derived C.C. ratings and tests for milk quality and the shedding, in the result, of those to enter the breeding stud and those to be eliminated. Thus representatives of the members in each region would choose the progeny recorded bulls to carry on the day-to-day service until the same show next year.

THE CENTRAL SIRE REGISTER

Today it is a sire's world. It always has been, his influence even in natural mating conditions being the predominant one. A.I. has increased this enormously. As a consequence we have created at the Board an A.I. Central Sire Register with information, like the Bureau of Records before it, available to all. It constitutes a permanent record for us and posterity of every attribute of genetic merit (or demerit) and survival value possessed by each sire in it. In due course it will span the generations of father to son and grandson and, being a record of progeny performance from birth to death, will include attributes of production, culling rates, fertility, conformation and dairy temperament: also the skeletons in the family cupboard, if any. The classification used in the Bureau of Records in 1945 was based on individual cows and herds. The creation of the Central Sire Register is in line with the change of emphasis that has occurred, for the genetic level and efficiency of our cattle from now on will be determined by the national stud of A.I. sires.

With quite a lot of ground still to cover, I do not propose to spend much time describing the selection of young sires for our breeding programme, for this, including test inseminations and laying-off, is well known. (Testing for meat as well as milk is a newer feature which I shall deal with shortly.) Several independent pieces of research into pedigrees with milk records in depth have shown that the connexion between a dam's performance and that of her granddaughters through her son is very slender indeed. The influence of the sire's progeny test comes through more strongly but even the two taken together are no substitute for the progeny test of the young bull himself. A good example of this is provided by two full-brothers (identical pedigrees) that were tested in A.I. and gave ratings of +77 gallons for one and -35 gallons for the other. The difference between the two is as much as one-third of the entire range of genetic merit for milk inheritance—from good to bad—as shown by ratings for large numbers of sires.

All that one needs to say about this summary is that of course the bull-mother, in spite of a low heritability, remains a key individual in young sire selection and that no-one is any longer surprised, the reasons being understood, that either full brothers or young bulls with equally meritorious ancestry should transmit so differently.

We have come a long way in breeding technique and practice from Cambridge in November 1942 to today with an A.I. service for 170,000 cattlemen, an A.I. Central Sire Register, the extended use of tested sires and methods for selecting and testing young sires. A healthy aspect of the scene is the fact that this large and now influential cattle improvement movement has been entirely financed and organized by producers for producers—their own boards in

England and Scotland and the managements of the Associated A.I. Centres. This is true not only of development but of research, on which large sums have been spent.

Originally intended as a service for commercial cattlemen, A.I. has proved in recent years increasingly attractive to those in the pedigree sector, and this has raised the question, on which I shall touch briefly and I hope objectively, of the function in the changed circumstances of dairy breed associations. The sire-testing process being as it is—expensive, elaborate and linked to A.I.—is likely to remain the province of A.I. centres and breeder companies, and there is plenty of room for both groups. It is also likely that breeders will increase their use of A.I. tested bulls, as is the practice in Denmark and Sweden. Their use in commercial herds means a levelling-up in genetic merit so that perhaps the difference is already very small between them and herds using and supplying untested young bulls. The latter herds will not wish to be over-taken.

Some breeders, including Council members, have questioned the value to a breed association of the large influx of members that has occurred in some in recent years. Do they contribute to the breed's aims and objectives? Would the breed association be better off by concentrating upon a service for smaller numbers? Anatomical studies are popular these days—Sampson's "Anatomy of Britain" and Unilever's "Anatomy of a Business," for example. A study of the Anatomy of a Breed Society has been undertaken to throw light on the membership and their herds in relation to the numbers of registrations, male and female, in the herd book:

*Membership and registrations in 1960:
Great Britain and Ireland*

Total membership	14,500
Members registering one or more animals (male or female)	10,500
Members registering one or more bulls	2,100
Members registering more than five bulls and more than twenty-five females	100

This analysis is for our largest breed association and there is no reason to believe that it is different from others. Knowing what we do today about the importance of numbers for detecting inherited characters of economic importance, it is probably true that most progress is likely to be made by breeders operating on a fairly large scale. It is for breed associations to consider whether or not to concentrate upon this sector as far as breed improvement is concerned. On the business side there is also scope for the development of sales of well-bred pedigree females already, in total, much greater than that of bulls. Among our four leading dairy breeds—Ayrshire, Friesian, Guernsey and Jersey—the years 1940 to 1960 saw a two-fold increase in male registrations (from 4,580 to 9,400), whereas female registrations increased more than five-fold (from 39,000 to 158,700). Compared to the sires' world of the A.I. movement, the dam's world may be the breed associations'.

There is also the export trade. History suggests that it was this incentive—the lucrative trade to the New World during the last century—that brought many of our breed associations into being, ten of them in the short space of thirteen years. For livestock the Continent of Europe will soon be open to us in a new way and we have also British Semen Exports Ltd. financed by breed associations and the A.I. movement. The reputation created abroad for our cattle by the combination of past achievements and modern breeding techniques provides marvellous opportunities for export sales.

A.I. AND BEEF PRODUCTION

"Beef from the dairy herd" is almost a cliché by now, and yet the subject is one of the most fascinating and stimulating phenomena of the cattle industry at the present time. To take our own business: we keep bulls of more beef breeds than dairy and this year will inseminate an estimated 780,000 cows from them out of 1,720,000 (45 per cent). Since 1949, when A.I. for beef began to get into its stride, numbers of steers under two years have increased from 746,000 to 1,695,000 in 1961. The beef contribution of the dairy herd of England and Wales, once regarded as a "by product", is now worth more than £120 million a year, coming close to one-half the value of milk sales (£280 million). Beef from the dairy herd is here to stay, for the affluent society at home and abroad demands more meat and this cannot be provided adequately from the traditional marginal and ranching areas of production here or in countries providing our imports.

The A.I. organization, designed for breeding for milk, is ideal for breeding for beef also and the scene is now set for genetic methods of selection that will lead to similar advances. There are before us the two main objectives of maximum economic return, by improved breeding, to the producer, and meat in the right places of the carcass for the trade and the consumer.

We introduced performance testing to England in 1955 for our young dairy bulls—mainly Friesian—at Chippenham. To date 200 Friesian bulls have been growth-tested and sire groups with a number of sons in each show differences in their average rate of gain; e.g., 2·06 lb/day to 2·64 lb/day, which means almost exactly a 2 cwt difference at one year old. With such a great contribution to home-killed meat from this breed we must continue to performance-test, though naturally placing milking efficiency first.

We have growth-tested groups of beef bulls in the same way, though on a smaller scale. We wait to see the outcome of the ferment of interest in the subject among beef breed associations, the R.A.S.E. and others who are interested. The sale of beef bulls for use in areas where A.I. cannot be used and for export is, of course, much more important than the A.I. requirement, yet schemes developed for the former may suit the latter. In the meantime our breeding programme will see an intensification of our plans for progeny testing, including carcass quality. To date our progeny testing for beef has been on a small scale, partly in conjunction with the Ministry and others, but the development of feed-lot enterprises for pure Friesian steers and beef crosses offers new scope for gain tests and the trial of new devices such as ultrasonics and photogrammetry for carcass assessment. Before long A.I. breeding organizations may find it sound practically and scientifically to own and operate progeny testing stations for this purpose; the Board will shortly be considering developments along these lines for its own beef-cross breeding programmes.

EXPERIMENTATION

I said at the beginning that, provided we maintain a good blend of experimentation and the commercial exploitation of the results, we can stay in the mainstream of technological progress. We now possess the organization and techniques to exploit genetic and other opportunities in the cattle world: what we have to see to is the promotion at all times of an adequate amount of experimentation. The Charollais episode is a good example of the great

stimulus to research provided by a suggestion to explore a new breed. The most elaborate and widespread trials of breeds, crosses and methods of beef production ever undertaken in Great Britain are the result. This is only one example of the kind of genetic exploration that should be going on the whole time with our own breeds, their crosses and trials of imported breeds. The plant and poultry breeders know well what they have gained from enterprise in this field.

In the competitive conditions of the Common Market, should we enter it, we shall need to know for sure that our cattle industry is based on strains as efficient as any. In a limited way we can say now, as a result of importations, how the genetic potential of our Friesians compares with that of the Dutch and the Canadian for milk yield. In a more limited way we shall shortly see something of the Red Danish breed's inheritance in our conditions. We have been invited to consider a trial of a Continental breed responsible for high-quality veal on the London market and there is interest in the breed origins of the popular Yugoslav beef. (Incidentally, genetic exploration and experimentation of this kind is also an excellent guide to levels of feeding and management. If Dutch Friesians alongside British on our farms do no better for yield but in Holland yield more, then the conclusion must be that the exploitation of their genetic potential is better in Holland.)

There is also experimentation to be done among our own breeds for qualities to suit changing market requirements. Text-book attributes describing some as "early" and others as "late" maturing, some as "improved" others as "unimproved", need re-examination; a breed's potential for production can only be discovered when tested across the range of commercial conditions.

Interest in cross-breeding for milk production is increasing, e.g., in New Zealand where the Jersey/Friesian cross may have a value for milk and beef greater than the pure Jersey. Some consider that hybrid vigour shows itself in greater ruggedness and longevity in commercial conditions; an extension of Dr. Donald's experiments at Cold Norton to test this would be most valuable.

In the past exploration and experimentation was carried out by pioneers and individuals working on their own. I have found recently a reference, to give an extreme example, of a herd of Zebu cattle imported from the East Indies by Sir James Murray, Bt., to Perthshire around 1790 and said to be doing well. (Bulls of this exotic breed were also being tried out by others in England. Crosses with the North Devon were described by a breeder as "fat as quails" at twelve months and exhibited at the Christmas Fatstock Show in the Haymarket, London.) Using home breeds other pioneers, for example in East Anglia, blended the Norfolk Horned with the Suffolk Dun or Polled to produce the Red Poll.

In spite of the number of breeds we possess, it would be completely unscientific to believe that evolution within or among them has reached finality. The A.I. organization, without in any way being diverted from selection among pure-bred strains, is in a position to assist those who wish to experiment in ways superior to those used by the early pioneers. Sound plans of operation can be made and followed through with objective measurement of results at all stages. Take, for example, a project to blend the best qualities of the South Devon, Jersey and Guernsey, first crosses of which exist in commercial herds. Properly organized it should be possible to combine in the blend some of the constitution and beefing qualities of the South Devon, the golden colour of the

Guernsey milk and the high milking efficiency and udder shape of the Jersey. A commercial cow could be bred to produce a quality of market milk desired by some and of a size adequate to produce a good beef steer when crossed with a beef breed.

There is no risk to the national economy in experimentation and genetic exploration of this kind, which may be conducted in grade or non-pedigree herds. Human nature being as it is, the number of those in any generation possessing the experimental interest is limited. Nevertheless, they exist and the attribute is precious, being the life-blood of progress.

We have, for commercial dairy cattle, established a breeding programme that is sound scientifically and practically and we are on the way to doing the same for a large and important sector of our own meat production. At the same time we have established an organization which, for genetic exploration and experimentation in cattle production for milk and meat, has very bright prospects for both.

Discussion on Dr. Edwards' Paper

A speaker from Jersey referred to Dr. Edwards' point on the value of the sire. From the pedigree breeders point of view it seems that one of our major tasks is to produce the females; how far does Dr. Edwards think that we have a useful job to do here to assist the A.I. centres?

DR. EDWARDS: This is a point I tried to bring out. The A.I. side deals with the sire and the Breed Societies with the females. I would never for one moment decry the importance of an individual female who is the bull mother and I admit that we want to know a great deal more than we do about cow families. The difficulty with all the research done so far is that statistics for cow families are never as plentiful as they are from sire progeny groups and therefore the person working with them, unless he has first-hand information about the cow and her relations, may miss something in the interpretation. I think therefore that if Breed Societies can organize this line of research they may be able to interpret the relation of the cow with her family in a way which has not yet been done.

MR. L. J. LAMBOURNE: (*New Zealand*). My question is closely related to the last one. Dr. Edwards indicated that bulls which improve herd production at high levels did so also in low producing herds. This is, of course, very consoling to people who are concerned with livestock breeding but it suggests an overriding importance of genetic merit. In New Zealand conclusive evidence has been produced that only a very small proportion of the difference in production between herds is due to genetic difference; the greater part is due to differences in environment, feeding and management.

DR. EDWARDS: From early on in this country the same facts were produced, namely that the differences between high and low yielding herds was not genetic at all but was in fact due to management, mainly feeding, and that is why I mentioned low, medium and high levels in terms of feeding and management. We accept that the great difference between the groups is in the kind of level you wish to feed for or are capable of feeding and managing for. You choose your own level and go for it but if you are selecting for superior genetic merit at one level you are also getting the kind of merit which will express itself at the other level. In other words you can find your bulls at the different levels and you can use them at these different levels knowing that in each case you are interpreting genetic merit.

MR. J. F. PERCIVAL: It has become very obvious during this talk that the only thing that really matters in the breeding of dairy cattle is progeny testing. In that respect I would like to point out one hazard that will arise if you carry on under the present system and that is that the progeny testing depends entirely on a small number of national milk recorded herds who use the A.I. bulls then rear calves and milk them through practically their entire life. We commercial farmers just cannot afford to breed animals if we have got to throw them out after the first lactation. It is much better for us to pay the extra money to get a proven bull which we know will produce for us cattle that we can keep in our herds during most of their milking life.

DR. J. EDWARDS: We are watching this the whole time because, just as the number of registered producers has gone down, so has membership of National Milk Records gone down in total numbers, but fortunately the number of cows being recorded remains the same, indicating, of course, the increasing size of herd. It is constantly in the mind of everyone connected with dairy cattle breeding that we must make sure we get all the information we need for progeny records. There is a study group sitting at the present time examining every aspect of this, including incentives. The other day we received a report from New Zealand on the second year of their new approach to progeny testing where instead of trying to collect records across the entire membership of National Milk Records they ask for volunteer herds in which nothing but young bulls are used in return for which certain incentives are given. The New Zealand Dairy Board is satisfied this year with the number of volunteers it has had. I think they can test all the bulls they want to, 160 young bulls in 450 herds, which shows what is possible by concentration on one feature in one group of herds. The study group is also considering other possibilities, such as simpler forms of milk recording, which will be cheaper and more acceptable, as opposed to the needs of the pedigree breeders who want a fairly complex scheme of recording. Private companies or A.I. groups working solely on the business of obtaining information for progeny testing might work with a simpler type of scheme.

MR. H. EDMUND: (*Warwick*). I was interested in Dr. Edwards' reference to the differences in liveweight gain between certain of his Friesian bulls. Liveweight gain in itself is not the main point; has Dr. Edwards any information relating to food consumed or the cost per lb of gain? In other words has food consumption been related to liveweight gain?

DR. EDWARDS: No, not in these particular records. Of course we shall hand out a great deal more on individual feeding and control of food with the

Charollais cross trials now about to begin but when I was in America three years ago I found most of the research workers there completely satisfied that the fast growing animals were also economic converters of food and in fact at some research centres they are so satisfied on this point that they have stopped weighing the food. American research workers are convinced that there is a very close connection between the efficiency of food conversion and liveweight gain.

SIR GEOFFREY HOWARTH: (*Cheshire*). One of the advantages and perhaps dangers of the Milk Marketing Board is the enormous scale of operation and from time to time undesirable recessives crop up in bulls at Milk Marketing Board Centres. Has the Board considered the early mating of young bulls with the nearest available relatives in order to show up at an early stage these recessives, if they are there?

DR. EDWARDS: We have not decided that it is necessary to carry out a strict back-crossing programme although one or two of the experts who advise us would consider this to be desirable. We think and there is very good evidence for this, that if a gene in a young bull is distributed in the population to an undesirable extent it will turn up in the test matings; I think the majority of our experts are satisfied that this is a sufficient safeguard.

Two questions were put from the floor of the hall. The first, why does not the Milk Marketing Board plough money back into the industry by means of royalties and so encourage co-operation between the breeders and the Board? Secondly, other countries make use of the results of the type classification scheme. Here we have not only the type classification scheme but the RMX scheme as well. More and more of the Breed Societies are considering adopting type classification. Would it not be possible for the Milk Marketing Board to co-operate with the Breed Societies in this respect?

DR. EDWARDS: There is no time to deal with the question of royalties in detail; that and other questions related to paying for bulls and support for Breed Associations is being gone into at the moment by the National Cattle Breeders Association and ourselves. As for the second question, I do not think it is right to say that we do not co-operate; we have RMX on pedigrees of individual cows but we have panels who may, in spite of the fact that a cow is RMX, wish to go and see for themselves. We use the RMX but we still inspect. As for the RMX herd classification I cannot see that this is of any great value to us since a herd classification can be arrived at in many different ways. If we use the RMX type of classification for progeny test purposes it might be applied in very much the same way as we use the individual RMX so far. But the RMX classification for a very big progeny group is a mathematical maze and very difficult to interpret. We keep to our seven points in our panel inspection classification and I notice that Mr. Thornher prefers three or even two.

The Chairman wound up the proceedings by thanking Dr. Edwards for his talk and for the way in which he answered the questions.

The Future Role of the Pedigree Breeder

C. W. MEIKLEJOHN

Chairman, British Friesian Cattle Society

I THINK I should make it clear that this paper represents my own views, and not those of the Council or the Society, though I should be very surprised if they disagreed with it but, since they have not seen it, they cannot be held responsible for it.

I suppose it would be normal to look back on the past and point out the enormous improvement which has been brought about by past breeders, working with the skill and knowledge which they had gained from living with and for their cattle. This is undoubtedly true and we could spend a lot of time tracing the development of herds and breeds to demonstrate this point. It would be nice to think that because this is true it must necessarily go on just the same. But in considering the role of the pedigree breeder in the future, we are not considering the same conditions, because the advent of A.I. has completely altered the whole structure of our industry and our consideration today must be given to whether we have a part to play at all and what it is. Does the breeder have some knowledge and skill that is valuable, or can all the breeding be done by some master mind, with the aid of a Committee of technical experts who meet regularly to consider the latest records?

Well, what has the breeder got? First, and most important, he's got the females. This may seem rather obvious, but it is important, because I don't think there is any doubt that it is family characteristics which transmit and the breeder knows the whole family over generations. If you have no experience of cattle, you can see it very clearly in the human race, from which, incidentally, you can learn a great deal about breeding, simply by keeping your eyes open—and it is all free! I believe that it takes twenty years to lay the foundation of a real herd and find the families which transmit and can be relied upon: indeed, the hardest job in building a really good herd is to stay alive long enough to see your plans come true. How often you find, when you go to a really good herd, that it was started by the present owner's father and they still seem to be doing very nicely. Yet I can think of three herds in our breed and in my own limited knowledge, started by enthusiasts who were only too willing to explain how to breed cattle and which have all disappeared. It is said that you never really know a man until you work with him and I need scarcely mention to most of you that you learn a lot you didn't know before when you start living with a female! One of the main reasons why I like to breed my own bulls is, not because I think my cows are better than anyone else's, but because I know more about them than I could possibly know about anyone else's. In one of the bulls I am using now, I can see in my mind's eye five generations of cows behind him and I know the conditions and environment in which they have performed. We need a lot more than just production. Good legs and feet and udders can be seen in the cattle that are still in the herd, but you can't see family temperament or ease of milking and you

can't see what is no longer in the herd—and let's be honest, when sales are involved, memory tends to become hazy! Then there is the knowledge of pedigree and the lines which do and do not nick. Can you really believe that breeders who spend their whole lives working with, studying and talking about cattle never learn anything at all, or that what they learn is all nonsense? It is this intimate knowledge of cattle and families which is gained from working with them over generations which can never be obtained by a visiting panel, or by office staff—and I, at any rate, am quite confident that the best results in breeding, particularly with the larger animals, will come from breeders whose herds are not so big that they cannot know them as individuals. I would admit that it may be quicker to breed for one characteristic which is measurable on mass production lines, like broilers, if you ignore the others, and this may be practical with broilers which are going to be dead in twelve weeks anyway and whose individual value is very small. But in the larger animals which we want to live for ten or twelve years or more and whose individual value may be £90-£100, we need many factors connected with physique and temperament which cannot be measured by a computer. I can think of no more depressing thought for a lover of good livestock than a countryside filled with broiler cows sired by computer-hired bulls. For it is this insistence on the priority of statistics and theoretical genetics that has caused the division of opinion in the livestock industry and produced the feeling that the Board doesn't consult the Breed Societies because it doesn't think they have anything to give.

We are not like King Canute, commanding the waves to go back. A.I. is here and will stay and may yet grow bigger. It is of tremendous importance to those who watch over the various breeds that the right bulls are used in A.I. and yet we have no direct control over the bulls, nor even the opportunity of expressing an opinion. I know that we are not alone in being worried at the standard of some of the bull mothers that were on show at the "Off-the-Grass" Exhibition. And if anyone asks "What can we do about it?"—the answer is that we can't do anything, because we are not consulted. I know that the Board's answer is that their inspection panels are democratically elected, but this seems rather like a man walking across a pedestrian crossing in front of a runaway lorry, happy in the knowledge that if he is killed, he will be in the right. We would not disagree with the production qualifications of these bulls, nor would we disagree that production must come first, but we certainly believe that it is all-round improvement that is wanted and that it is not necessary to use cows of this calibre in order to get production. Ever since breeding has been going on there has been a search for proven sires, but this has always meant an all-round improver and not the Board's new idea of sectionally proven bulls. This bull is proven for one thing; this one for something else, and that one for some still further factor.

Improvement of a herd or a breed on an all-round basis is a slow process which must proceed a step at a time, trying to add the factors in which the herd or breed is weakest without losing the good characteristics which are already there and this cannot be done without an intimate knowledge of both sides. We, as breeders, believe that it is not just a fad to try to breed good looking cattle. Certainly production must come first but, with production, we want the characteristics which we consider to be good looks, because these are based on practical considerations, quite apart from the fact that if you have to spend your life with cattle, it is much pleasanter to have cattle in which you can take a pride. Furthermore, it is an economic advantage. If you

put two cows with the same qualifications on the market—one good-looking and one plain, there is no doubt which will make the most money.

But let us be clear as to what we mean by a "Breeder". I don't mean anyone whose cattle happen to be registered, but the enthusiast who knows what he is trying to do and where he is trying to go. These are the Breeders who mould a breed and supply the top breeding stock, but not all the enthusiasts have got to the top. If you have money and knowledge, you can buy someone else's work and start halfway up the ladder, but the majority have to start with occasional cows as and when they can afford them and one of the problems facing the industry in these times is to find the incentive for the younger breeder to climb the ladder, or even to start to climb. Every industrial and manufacturing concern sets aside certain sums—and sometimes very considerable sums—for research and development. This is a normal part of production cost. The Pedigree Breeder doesn't consciously set aside any particular sum, but the process goes on, just the same. All the costs of registration, of milk recording, and now, type-classification, as well as the cost of advertising and showing (which is part of advertising) come under this heading, as well as the cost of testing and keeping bulls, because no keen breeder would dare to put all his trust in one bull for his whole herd until he knew what it could do. This breeding research and development has been paid for in the past, not merely by increased value of the herd, but also by the sale of bulls and bull-calves, even if not registered, and it is this incentive which the A.I. Service has very nearly wiped out, except for the breeders who are already at the top and, even for them, it has dropped. It is this incentive which we must try to replace, because the incentive value is far greater than the actual sum which may be returned. The aspiring breeder must feel that all the costs of pedigree breeding are at least going to give him a chance to get a worthwhile return for his effort. If that chance is too remote, then the young men will have no incentive to try and become successful breeders and the source will dry up: don't forget, it's a slow and expensive business! But if we believe that the breeder has the greatest contribution to make in the improvement of cattle, it doesn't mean that we think that science has no part to play, or that everything will remain just as it is. Herds are getting bigger already and we may well see more groups of breeders, who are on the same lines, co-operating further in testing bulls. I believe that the great breeders of the future will be real cattle men in the first place, but they will be men who are equipped and prepared to use every help that the geneticists and the statisticians can give them. But it must be that way round. As the R.A.S.E. motto says—Practice with Science—not Science with various reports on practice. I am certain that the improvement of the country's cattle, which, after all, is surely also the Board's objective, will make the knowledge and experience of the breeder even more valuable in the future. This is not a question of which side is right, but of why can't we have some real co-operation. It is not only the breeders who have been under fire; it has been publicly stated that the Breed Societies are on the way out. We need to consider their functions and the part they have to play in the future. If one may judge from the number of appeals which come to my Society, both for money for donations, for blood-typing or for export or for practical help in demonstrations like "Off-the-Grass", some people still think that the Breed Societies have their uses. It is suggested that the Breed Societies are simply Registrars of Births, Marriages and Deaths—a function which could easily be taken over

by some other body and that they are pre-occupied with showing and unimportant details. It is, of course, true that the process of registration requires a considerable number of staff and is a considerable expense to any Society and yet it is only a small part of the operation of that Society. It is simply the mechanics of the thing which make the rest of the work possible. The main work of any Society is to promote the welfare of the breed and to lay down and operate incentive standards which will guide their breed in the direction which the Council believe will be not only in the interests of their breed, but in the national interests as well. Any Breed Society which tried to guide its members into policies which were against the national interest would certainly fade away and would deserve to do so.

Perhaps I should apologize here for talking about Friesians. This is not because I am aiming at some cheap publicity for the Friesian, but because it is the only breed and Society about which I really know anything. It is now thirty-one years since I joined the Friesian Society and sixteen years since I was first elected to the Council. During that time and, indeed, since the formation of the Society, which was only fifty-three years ago, as you can see by reading the history of the breed, the objectives have always been clearly laid down and stated. May I read you part of the late Trevor Williams' Presidential Address at the A.G.M. in 1917—a year when we had reached six hundred and twenty seven members:

"To the newer Members of the Society, I should like to say, breed for type, breed for milk, breed for butterfat and breed for size; unsex your bulls that are not of the best parentage, and fatten them; keep your bulls to a much greater age than is practised in other breeds in the country. If you have not a really good bull, send to someone who has, and wait patiently until you get a good bull of your own. Let your motto be—Never use a bad bull, and if it is within your power, never let anyone else use it."

Is there much wrong with that for today? I am sure you don't need to be a Friesian breeder to see the vast improvement that has taken place, from the collection of animals that was inspected into the first herd book, to the very much improved cattle that we have today. If you are not sure, compare some of the winners of the early Royal Shows with those of recent years. And that has come about during a period in which we have held, and indeed, increased our production lead over the other breeds—and raised our butterfat from a level which was subject to criticism to a level which we believe is the optimum for today. This has been done by the skill and enthusiasm of private breeders, as a direct result of the policies laid down by the Society and let us admit that in the last few years, A.I. has played its part in carrying that better blood to the commercial farmer at a very cheap rate and in raising the standard of commercial cattle. These improvements in production have been achieved by the incentives of the Register of Merit which have been raised four times, always keeping them just far enough in front to encourage breeders to achieve them. To that production incentive we have now added Type Classification, because we felt that the over-emphasis on production was tending to produce an unbalanced objective. Since the Type Classification Scheme was launched over twelve thousand females have been classified, and over the years, a picture will build up of the lines and bulls that are producing the cattle we

want in conformation as well as production. Before I describe this in more detail, let me emphasize that no Type Classification Scheme, no production figures, no statistics, can absolve the breeder from doing his job. All these figures can only give guidance of the direction in which to go, of the herds in which you may find what you want.

We now have three full-time Field Officers and we have spent a lot of time trying to ensure that this classification is done to a level standard. Let me emphasize that classification is not judging and condition should not influence it, but classification against an ideal model by means of the Type Classification Breakdown Sheet. On this Sheet, there are fifty-eight items and squares and the field officer inspects the animals one at a time, outside, and marks, by means of a tick in the square, any item in which the animal is deficient. One tick for slight defect; two ticks for more serious defect. He then fills in the score card breakdown, which consists of eight headings: GENERAL APPEARANCE; DAIRY CHARACTER; BODY CAPACITY; MAMMARY SYSTEM; FORE-UDDER; REAR-UDDER; LEGS AND FEET, and RUMP—and then general characteristics of size and style. The eight headings are filled by letters indicating the six classes—EXCELLENT; VERY GOOD; GOOD; AVERAGE; FAIR; POOR—and from these he gets the class into which the animal comes, and its score in the class. This is very much the same as the Canadian system, but we believe we have improved upon the system by separating the heifers from the cows. At first, heifers were classified in the same way as cows, but because heifers often look better than they will ever look again, particularly in the udder, they were classified on the low side, which made the good heifer unrealistic. We now grade heifers into six grades—H.1—H.6, using the same method, but with no score, and they cannot be classified until they have had their second calf.

Complementary to the Scheme, the Society keeps records of the production of all cows and bulls' daughters and their type classification when available. Incidentally, my own Society pay the Board over £5,000 a year in buying back the milk records of our Members. Members can obtain yields of cows and their daughters, production of bulls' daughters, extended pedigrees giving these details—a mass of information and more and more will become available. We publish every year a production register containing the unselected yields of all bulls which have at least twenty recorded yields including ten first-calf yields; details of all R.M. cows and their yields; of R.M.X. and R.M.L. cows (that is, cows that have given fifty tons or more) and the names of all bulls that have become R.M. with their unselected daughter averages. All these services are invaluable to the serious breeder, but they all cost money, both to the Society and the breeder and, if progress is to go on, it is essential that there should be some return to both from the A.I. user who gets all this work for less than the cost of keeping any old bull.

I believe that this will come, because it will unlock the door to a vast amount of real co-operation. Is it impossible to imagine a situation in which the Board passes on to the Societies all the statistical information which it has and the Societies help the Board to find the best bulls for A.I.? Can you not imagine a situation in which the best breeders are only too anxious to have their most promising bulls tested at A.I., secure in the knowledge that if they are as good as expected, the breeders will get a commensurate return? A situation in which the Board's geneticists would come to our Meetings if we wanted advice and in which we could be represented, when the choice bulls were being considered by the Board. The influence of a bull at A.I. is so great

that the standard should be every bit as high as the best breeders would insist on. Is it unthinkable that the Societies should nominate one or two members to the breed panels in order to help and to safeguard their own breed? This might well be, in some cases, the members who are already elected, because I can think of one or two panels for which we could suggest no-one better. Is it impossible to visualize a situation in which the breeders do the breeding, assisted by all the information the geneticists and statisticians can give them, possibly even information supplied to them by the Societies and, in return, do everything they can to help the Board get the best bulls? Is this real co-operation just a dream? I don't believe it is, but real co-operation means a partnership and a partnership means fair shares. If we have that condition the goodwill and wish to co-operate is certainly not lacking on our side.

I am certain that the pedigree breeder has a very important part to play in the future and I am equally certain that the benefit to the Board, of the two sides working together rather than against each other, would be immense.

Mr. Chairman, If this Conference has been a platform from which the scientists on the one side and the breeder on the other can put their points of view, the one against the other—then the whole thing has been a waste of time, and we had far better stayed at home. But if, as a result of this Conference, we could forget some of the things that have been said in the past; if we could recognize that each side has a job to do, which is complementary and not antagonistic and if we could reach that real co-operation and partnership, then this Conference will go down as a landmark in the history of Livestock Breeding.

Discussion on Mr. Meiklejohn's Paper

MRS. KENNEDY: I should like to take this opportunity of thanking Mr. Meiklejohn very much for what he has said and to support him in his contention that there is no doubt whatever that production and conformation are akin to one another. A lot of people have said that, as long as an animal produces well, it does not matter much what she looks like, but this is not so.

MR. R. H. WHEELOCK: I have for twenty years been a pedigree breeder of the same breed of cattle that Mr. Meiklejohn owns and I am most interested in the idea of a man coming to my farm to inspect the cows and marking them up on a card. My definition of a good dairy type is a cow that gives you a good profit. How on earth does a card help me with that?

MR. MEIKLEJOHN: It does not pretend to; the card is introduced to help to improve the type of animal as a counter to the heavy emphasis which has been placed on production. It is only because we believe that, on the whole, type is

ties up with production that we have introduced this scheme, but there is no need for you to follow it.

MR. KENNEDY: (*Fife*). My interpretation of what has been said today is that the geneticists are placing more emphasis on the male and that the pedigree breeders are placing emphasis on the female. It appears that the male has most effect on production and the female on conformation; perhaps Mr. Meiklejohn would comment on this?

MR. MEIKLEJOHN: Writing many years ago, Mr. George Hobson, who was then the Secretary of the Friesian Society, reported his conclusion that the male influenced yield more than the female and that the female influenced looks. I cannot prove this but I do think there is something in it. You cannot separate these things, and in any event, the argument is not about proven bulls but about young bulls and whether one should rely entirely on production figures and more or less ignore the female side. Neither the geneticists nor the breeders can be sure of getting a good bull every time and all that we are trying to do in breeding is to reduce the chance of getting a bad bull. This I think we can do, and what we ought to do is to get together to do the job instead of bickering about the right way to do it.

DR. BOWMAN: In his answer to an earlier question Mr. Meiklejohn suggested that one should select for type because one wanted animals to look nice, but I suggest that if you select for type and it costs something in production then the animals are not as profitable as they would otherwise be. Most farmers are in agriculture for a living and they can't afford to select the things which are not going to make them money. This is, perhaps, where there is a divergence of opinion; the scientist is basing his decision entirely on whether it is going to make money whereas a pedigree breeder is to some extent selecting for traits which he fancies himself.

MR. MEIKLEJOHN: I don't think I said anything of the sort, but insisted that production must come first. But, having got production, surely it is better to have animals which we believe are the type that will live and work for a long time. There are many practical points related to conformation which affect production and surely it is better to have them than not to have them.

CHAIRMAN: I am glad this point has been raised because I feel that this is at the root of some of the misunderstandings that exist. Conformation is of vital importance for production and we can't over-emphasize this point. As evidence of this, the experimental production classes at the Great Yorkshire Show last summer did emphasize that the animals which were placed in the top group for conformation were also the highest producers.

MR. J. M. WATT: As a commercial farmer I am looking for the best possible animal and I have come here today to see what the future holds for the livestock industry. It seems to me that the geneticist has more to offer me than the pedigree breeder. Is there not a place for better co-operation between the geneticist and the Breed Societies regardless of breed? I would like to see some sort of organization that could give us a very clear picture of where the breeds and the livestock industry are going.

MR. K. S. BAWTREE: I support the last speaker; the National Cattle Breeders' Association is doing all it can to bridge this gap and I am sorry that

Dr. Edwards has not been able to stay this afternoon. However, there are other of his colleagues from the M.M.B. in the room and I should be grateful if some of them would put forward their views.

MR. J. B. FARRANT: As a member of the Milk Board I would like Mr. Meiklejohn to explain his implication that he, as a breeder, has some mystique known only to him but not to a panel that comes to inspect his animals. Can Mr. Meiklejohn give one instance where the Board has said that it prefers a plain cow to a cow of good type? I would also like Mr. Meiklejohn to elaborate further on the lack of co-operation.

MR. MEIKLEJOHN: I never said that I had any knowledge which nobody else could have; what I said was that when a panel comes to the farm they come as buyers of a cow selected, in the first place, in the Production Division. The only time a panel came to see a cow of mine they had selected an animal which had never struck me as being a bull mother, but if they, as buyers, wish to use animals of this kind it is not for the seller to refuse them. But would it not be better to seek the advice of the breeder as well as their own statistics?

I don't think the Board has ever specifically stated that it wants a good type cow, and as for lack of co-operation I think we have suffered from this for many years. I don't think the Board, so far, has been prepared to go far enough in meeting the breeders but I sincerely hope that we shall, in future, have some real co-operation.

MR. J. S. MORREY: As a one-time member of an A.E.C. with the doubtful privilege of inspecting nearly half the cows in one of the most intensive dairying counties in the country, I cannot help but think that the picture which I see now is vastly improved compared with those old days, due very largely to the introduction of A.I. The progress here is tremendous. Surely, the role of the pedigree breeder is to provide us, the M.M.B., and any breeder who does not want to use A.I., with stock of higher and higher merit. I would like, also, to remind Mr. Meiklejohn that the M.M.B. is a buyer of pedigree cattle just as any private individual is, and surely as buyers of stock the Board can choose where it likes knowing that if it does not satisfy the requirements of the users of A.I. it will soon be told so.

The panels of buyers for the Board are the users of A.I. and they are free, within certain limits, to co-opt who they like to these panels. Surely the buyers are the people to set the pace and not the sellers.

MR. MEIKLEJOHN: The thing we want to do is to co-operate with the Board; if you believe that you have all the answers and that there is no necessity for any help in buying bulls you are perfectly entitled to think so. We breeders feel that we could help to avoid some of the things which are going wrong, and which have gone wrong. Some of the bulls have been disappointing, which many breeders expected, and which I think might have been avoided.

MR. D. S. EDWARDS: Mr. Meiklejohn said that the breeder had to choose a good bull and not use a bad bull. What method does he use to decide what is a good bull, and what is a bad bull, and how do we find the good ones?

MR. MEIKLEJOHN: You are referring to the quotation which I made from Mr John Williams' address but I think the breeder who has been at his task for some time has a good chance of picking out a good bull. Everybody has got to test the animals and I am not suggesting any magic methods by which you

could go out privately to buy a good bull any more than the A.I. committees can. There is a feeling abroad that the Board intends, to a large extent, to breed its own bulls, and earlier today Dr. Edwards said that the provision of the sire is a matter for the Board and that of the females for the breeder. What I am saying is that if all the information from both sides could be got together our chance of advancing would be much greater.

MR. C. W. SCOTT: The disagreement between the breeders and the Board seems to stem from two things. Firstly, the breeders feel that, because of their experience, they can improve cattle in more than one attribute at a time, whereas geneticists tell us that they cannot achieve improvement in more than one point at once. This is true if you want an immediate result but cattle breeding is not a short-term business and we have got to look at more than one point. The other problem is that A.I. has taken a source of finance away from the cattle breeder and if we could only get some system which would allow some of the profits that arise from a successful bull to go back to the breeder nearly all this acrimony would disappear.

MR. MACDONALD: I am very pleased to hear Mr. Meiklejohn say that what the Breed Societies want is co-operation from the Board. The Board also wants co-operation, and there is co-operation. We are asking for the breeder's co-operation to get the bulls that we want for our A.I. centres. We should like them to tell us which of their cows are the ones that, in their opinion, should be the mothers of bulls. We do operate a private breeders' Bull Proving Scheme whereby we give facilities to private breeders to test their young bulls through A.I. Mr. Meiklejohn has, I think, painted too black a picture; but he said that there will be co-operation on his side and I am certain that this applies also to the Board.

MR. MEIKLEJOHN: I am delighted to hear Mr. Macdonald's views and it may be that I have over-stressed my case in order to make the point. I know that there is a certain amount of co-operation and I hope that there will be a lot more.

CHAIRMAN: On this co-operative note I think we must end the discussion and thank Mr. Meiklejohn for his excellent paper and replies to questions.

Report of the Beef Panel

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OVER the past twenty years there have been fewer changes in breeding and selection practices in beef cattle than in any other farm stock in Britain, with the possible exception of sheep. The situation contrasts strongly with that in the poultry industry in which there has been a complete revolution. The supply of day-old chicks is now mainly controlled by a few large concerns which are applying to their breeding and selection methods principles which have been established through advances in population genetics.

Though the pig industry has not yet experienced changes of great magnitude, despite sharing some of the breeding advantages enjoyed by poultry, there are indications that breeding methods will be vastly different in a few years' time. There are now five progeny testing and two performance testing stations for assessing the breeding potential of stock in respect of food economy, rate of gain and carcass quality. Some commercial pig producers will no longer be at a disadvantage as compared with their Danish counterparts in respect of the quality of breeding stock. More than this, the progressive breeder will be in a strong position to exploit the export trade because his pigs will carry the hall mark of objective assessment in respect of characters that really matter to those who produce pig-meat.

Whether pig-breeding will become the function of very large concerns is a matter of conjecture, but it is in the power of individual breeders to survive provided they combine to use the information that progeny and performance testing are making available.

The pig industry is fortunate, too, in that it now has a central authority, covering all aspects of pig production and, especially in our context, breeding. It has the staff to interpret data that performance and progeny testing are accumulating, and it has the finances to promote research to make good gaps in knowledge. Recently there has been a first-class example of what can be achieved in this direction. Complete dissection of bacon carcasses has revealed that current grading standards as well as standards being used in progeny testing do not adequately reflect the commercial value of carcasses. The information that this study has revealed will result in a more precise definition of breeding objectives. The beef industry has, however, only very inadequate subjective standards on which to base selection for carcass quality, a point which will be discussed subsequently in greater detail.

The dairy industry in England and Wales also reflects the benefit of having a single authority concerned with improvement of dairy stock regardless of breed. The Production Division of the Milk Marketing Board has made some very remarkable contributions since it assumed responsibility for recording and for the major part of artificial insemination. The latter has in the course of twenty years become a potent method of national herd improvement. Selection of mates for 60 per cent of the national herd is now the responsibility not of tens of thousands of farmers with limited knowledge of

breeding principles but of relatively small experienced groups; these have carried a great responsibility, and in order to discharge it they have used recording data critically to assess the efficacy of their selection. The development of the technique of contemporary comparison has given a reliable method of assessing the breeding worth of sires. Analysis of performance data has provided a more certain basis for the selection of young sires, and it may be fairly said that the Milk Marketing Board, and the companion A.I. organizations, have provided the breeders of pedigree dairy cattle with vastly different objectives than those that were considered important ten years ago.

Recently we have had examples of several leading pedigree Friesian breeders combining to progeny test teams of promising young bulls in outside herds using artificial insemination. They have realized that even their comparatively large herds are individually insufficient to undertake systematic and large-scale progeny testing. In the same way as the Milk Marketing Board does, they are using the herds of commercial dairy farmers as testing grounds so that proven sires may be available for their own herds in order to retain and enlarge their nucleus function.

In a sense these breeders have sacrificed independence, but presumably they have done so in the knowledge that their chances of individual success are less than with a pooling of resources to create a sufficiently large population of breeding stock to develop progeny testing and to exploit superior animals revealed by such testing. Their example, the individual breeders' alternative to the large-scale company breeding of the poultry industry, can, we believe, have its parallel in the beef industry. We realize that there is already a measure of collaboration between beef breeders. We hope that this can be strengthened by measures we will subsequently suggest. Before considering these and other developments in beef breeding it is necessary, however, to consider some aspects of organization in the beef industry in order to define breeding objectives and to provide a perspective for proposals.

SOURCES OF SLAUGHTER CATTLE

Unlike the Argentine, the United States and the three oldest Dominions, the beef industry in Britain is based less on special purpose beef breeding herds than it is on the dairy industry. This is largely a reflection of the land scarcity and the small size of farms in Britain. Because beef cattle are probably the least efficient of all farm animals in terms of land use, specialist beef production is a characteristic of cheap land which is managed in large units. Table I gives an estimate of sources of beef slaughtered in Britain for human consumption.

TABLE I
Estimate of sources of beef slaughtered in Britain for human consumption

Type	Number	Wt of beef (million cwt)
Irish Stores	500,000	2·6
Beef-bred stores	600,000	3·1
Discarded breeding stock	700,000	4·0
Dairy bred Stores	1,000,000	5·0
TOTAL	2,800,000	14·7

The home-bred beef stores are the produce of 800,000 single suckled cows, some of which are by beef bulls out of dairy and dual-purpose cows. The bulk of the imported Irish stores are out of dual-purpose cows. On the basis of artificial insemination figures it would appear that about 300,000 of the dairy bred stores are by beef bulls.

These figures establish the dominant place the dairy industry has in providing the dams of beef stores. At the same time the contribution of beef breeds to slaughter cattle, other than discarded breeding stock, is substantial. All beef-bred stores, most of the Irish-bred stores, and 30 per cent of the dairy-bred stores are by beef bulls. It is estimated that two-thirds of the stores reared for beef, including Irish stores, are sired by bulls of beef breeds. The proportion could increase with a reduction of wastage rates in dairy herds which would allow dairy farmers to mate a higher proportion of their herds to beef bulls. This will happen only if there is an assurance that beef crosses are a better commercial proposition than straight dairy-bred stores. It is not clear that this is the case with Friesians, for no crosses with beef breeds have exceeded pure Friesian steers in weight-for-age tests conducted on Ministry Husbandry farms. The pure Friesian steer appears to be preferred for intensive "barley beef" because of its late maturity, which means economic food conversion is still maintained up to relatively high weights, i.e. 8½-9 cwt.

Apart from this reservation it is clear that beef breeds play a very large part in determining the quality of stores for fattening. Because such a high proportion of these stores are out of cows kept primarily for dairying, it is important that the beef bulls must do more than improve weight for age; they must be improvers of carcass quality.

STRUCTURE OF PEDIGREE BEEF HERDS

There are eight breeds which may be classified as special purpose beef breeds. These, with two polled derivatives, are listed in Table 2. Of these the Galloway and West Highland have a special function in that they are hardy breeds, adapted to difficult environments. The Lincoln Red, Sussex and North Devon tend to be local breeds, but the remaining three, the Hereford, Aberdeen Angus and Shorthorn, have an international as well as a national importance. Within Great Britain, the Aberdeen Angus, and to a lesser extent, the Shorthorn are more popular in Scotland, while the Hereford is the most important breed in the rest of Britain. It accounts for over 60 per cent of beef bulls licensed in England and Wales, and also for more than half of inseminations from beef breeds.

As Table 2 shows, the average size of herd for all breeds as measured by average registrations per herd, is small.

Only the Lincoln Red has an average of more than ten females registered per herd. The two principal breeds, the Hereford and Aberdeen Angus, average less than four females and less than three males registered per herd. The typically small scale of operation is further illustrated by the figures given in Table 3.

A notable feature is the high proportion of herds which registered either no males or no females in 1961. Another is the very low proportion of herds in all four breeds which can undertake either performance or progeny tests,

involving the progenies of two or more bulls. The position is probably somewhat better than the figures below disclose inasmuch as final registrations are fewer than notifications of births because breeders are adopting some measure

TABLE II

Number of Herds and Total and Average Registrations of Males and Females by Breeds in United Kingdom and Eire (1961)

Breed	No. of Herds	Males Total	Registered Per Herd	Females Total	Registered Per Herd	Male: Female Ratio
*Devon ..	353	164	0.5	2,119	6.0	1 : 13
*Polled Devon ..	28	21	0.75	125	4.5	1 : 16
Shorthorn ..	199	900	4.5	1,066	5.4	1 : 1.2
*Lincoln Red ..	131	176	1.3	1,380	10.5	1 : 8
*Polled ditto ..	62	185	3.0	587	9.5	1 : 3
Sussex ..	140	121	0.9	1,262	9.0	1 : 10
Aberdeen Angus ..	1,350	3,541	2.6	4,741	3.5	1 : 1.3
Galloway ..	568	768	1.3	3,886	6.8	1 : 5
Hereford ..	2,047	5,788	2.8	7,592	3.7	1 : 1.3
Highland ..	141	63	0.4	346	2.5	1 : 5
TOTAL	5,019	11,727		23,104		

* 1960 figures.

TABLE III

Herd Registrations of Males and Females by class intervals for Four Beef Breeds (1961)

Males	Number of Herds			
	Shorthorn	Galloway	Aberdeen Angus	Hereford
Registering None	42	294	303	389
1-5	100	243	855	1,355
6-10	32	28	132	197
11-20	16	3	56	89
21 or more	9	0	4	17
TOTAL	199	568	1,350	2,047
Females				
Registering	Number of Herds			
	Shorthorn	Galloway	Aberdeen Angus	Hereford
None	31	14	314	409
1-5	97	300	731	1,236
6-10	40	130	185	207
11-20	23	103	106	144
21-30	8	17	11	37
31 or more	0	4	3	14
TOTAL	199	568	1,350	2,047

of selective registration. It is clear that very few herds have sufficient strength to embark on independent programmes of progeny testing. There is, however, rather more scope for performance testing within herds provided breeders are prepared to do all they can to maintain a uniform environment for their rearing stock so that comparisons are realistic.

The general situation points to the need for very close collaboration between breeders, especially those with less than twenty registrations of males and females if they are to enjoy the benefits of progeny testing. The logical method would seem to be some form of contemporary comparison similar to that in the dairy industry where teams of promising bulls, placed under test, have offspring in many herds. The most convenient method of attaining this would be by artificial insemination, at present not permitted for pedigree cattle by breed societies though it could be used for progeny tests with non-pedigree cattle. We believe that such a restriction is not in the interests of breed improvement, because artificial insemination can be such a potent tool, not only to effect collaborative action between breeders but also to spread the value of really outstanding sires in pedigree herds. At the same time we recognize the justified fears of breeders who depend largely on bull sales for their income, and in a later section attention is given to this point and the possibility of introducing some form of royalty payment to provide an additional reward for breeders of outstanding bulls.

One further feature of Table 2 which requires comment is the narrow ratio between male and female registrations for the Shorthorn, Aberdeen Angus and Hereford breeds. In each case it is only a little more than unity. This is a reflection of the demand for crossing bulls from these breeds but even allowing for some pre-registration culling, these narrow ratios suggest that selection of bulls in these breeds may not be sufficiently intensive to give all commercial breeders the quality of bulls they require.

EXPORT TRADE IN BEEF CATTLE

Stress has been placed by breeders on the value of the export trade to the pedigree beef industry. The Livestock Export Council has not been able to give information on the value of exported beef cattle by breeds nor any division into sexes. In 1961, the total number of exported beef cattle was 707 including 176 Aberdeen Angus, 192 Herefords and 190 Shorthorns; total beef cattle registrations were approximately 36,000, so that exports accounted for 2 per cent of annual registrations. Shorthorns did not conform to this average in 1961, for exports amounted to nearly 10 per cent of total Shorthorn registrations, but Herefords and Aberdeen Angus approximate to the average figure. Apart from the Shorthorn it cannot be argued from these figures that the export is quantitatively very important to the general run of breeders, though it is recognized that the presence of overseas buyers will be a stimulus to prices, as well as to interest in pedigree breeding. At the same time it is not certain that Britain will hold her present level of exports of beef cattle if steps are not taken to supply the kind of stock importers require. We will have to keep abreast of overseas developments if we are to maintain, let alone expand, our export trade. Fortunately there is no conflict between overseas and domestic requirements if good commercial attributes, rather than arbitrary concepts of type, are the criteria on which livestock are judged. In serving the needs of British beef producers, the pedigree breeder will be safeguarding the export demand for his stock.

BULL LICENSING

The panel considers that the purposes and procedures of bull licensing should be reviewed. It was instituted some thirty years ago to deal with a serious scrub bull problem which has been greatly reduced because of the widespread use of artificial insemination.

In its present form licensing may eliminate a proportion of bulls with obvious physical defects that cannot be masked by feeding, and in this respect it is probably useful at the lowest end of the scale. It does not, however, make a positive contribution to livestock improvement in that it does not assess or emphasize characters such as weight-for-age or muscle development. Assessment of a bull's breeding worth by his appearance is not sufficient to satisfy present-day requirements. Moreover the continuance of licensing in its present form possibly engenders a feeling of complacency and thereby constitutes a bar to the development of more realistic methods of determining or improving breeding worth. We look forward to the time when records of performance will supplement visual appraisal as a basis of bull licensing. In the meantime it might be advisable to restrict licences to pedigree bulls. This would throw squarely on to the shoulders of breed societies the responsibility for safeguarding type in their own breeds. The cost of this might be borne by the national authority envisaged below (page 52).

Nevertheless provision must be made for progressive breeders to use cross-bred or non-pedigree bulls in the formation of new breeds (including polled varieties of existing breeds). It may also be necessary to frame regulations which will permit the production of bull beef, slaughtered before fifteen months of age, a system now popular on the Continent.

OBJECTIVES IN BREEDING BEEF CATTLE

Though the panel has been concerned primarily with commercial objectives, it recognizes that breed societies have other considerations relating to breed type. If competition between breeds becomes more intense, as a consequence of recording and performance and progeny testing, any breeder who pays undue attention to fancy points will find himself at a considerable disadvantage. Breed societies should undertake immediately a re-appraisal of their objectives and in doing so, particular attention should be paid to the following traits:

- a. weight-for-age.
- b. economy of food use.
- c. fertility.
- d. carcass quality and, in certain breeds,
- e. mothering and management qualities, and
- f. adaptation to special environments.

In view of the diversity of conditions under which beef cattle are kept it is important that breeds should not all have identical objectives. It is not for the panel to say what each breed function should be, for this a policy decision that can only be taken by societies.

Weight-for-age is important for two reasons. First, it is a commercially desirable objective in itself, and secondly, it is highly correlated with economy of food use. It is a matter of great concern to the owner of a single suckled

herd that his weaners should average six rather than five cwt, for weight is the most important single factor determining the value of a weaner. Similarly for the fatterer, animals that are fast growers on a given feeding regime are much more economical than those that grow at slower rates. Fortunately weight-for-age appears to have a reasonably high heritability and this means that the performance of an animal is a good guide to its breeding potential in respect of this trait, and also to economy of food use.

Weight-for-age must not be considered without regard to carcass quality because it would be to the detriment of a breed if as a result of a pre-occupation with gains it became badly proportioned and produced wasteful carcasses from a butcher's standpoint. Unfortunately we have very inadequate definitions of carcass quality. The beef industry is in urgent need of studies in order that carcass quality may be defined more objectively; this could advantageously be made one of the first tasks of the proposed Meat Research Institute. Certainly we cannot accept conventional type appraisal as a satisfactory indication of carcass quality. It is, however, safe to advocate selection for maximum muscle development because the amount of fat in the carcass can be influenced by degree of finish. Distribution of fat is, of course, another matter, and here it is important to determine the importance of distribution in determining carcass quality and also whether distribution of fat is greatly influenced by selection.

There may be differences of opinion as to the emphasis that should be placed on milking and adaptive qualities in breeds providing bulls to produce slaughter cattle. It is a cardinal principle in livestock improvement that the more breeding objectives there are the slower progress will be towards given ends. With some breeders in some breeds the problem has already been resolved in that it has been found necessary to use nurse cows and supplementary feeding because purebred dams have insufficient milk to permit their calves to show their growth potential. This could be to the detriment of the breed if one of its functions is to provide single suckling cows for extensive farming conditions either in this country or abroad, but so far as much of our domestic beef production is concerned transmission of milking qualities has less importance where sires are mated to dairy or dairy cross cows. Most of their offspring will go for slaughter, and such of the heifers that are kept for breeding will have the benefit of their dairy ancestry.

It is a different matter in breeds required for difficult environments. Performance recording could only be meaningful if stock are maintained under conditions approximating to commercial practice. For this reason, if farm recording increases, as we hope it will, within pedigree herds, it will be important to avoid a situation such as still exists in the dairy industry where high yielding herds owe their apparent superiority to husbandry rather than hereditary factors. *The importance of farm recording rests not in comparisons between herds but on comparisons within herds so that the breeder has a basis for culling.* Determination of the breeding value of a breeders' stock relative to those of other breeders becomes a function of the central performance test station or of progeny testing with precautions to minimize environmental effects.

Because of the small numerical size of breeds, there is little scope for specialized strains within them. We consider that specialization of function should be on a basis of breeds. With eight of them all conceivable requirements for British conditions should be met.

MEASUREMENT OF PERFORMANCE OF BEEF ANIMALS

Unquestionably the beef industry has been at a disadvantage because it has had no organized measurement of performance to produce factual data essential for formulating breeding plans. So far as on-farm recording is concerned, apart from the pioneer efforts of a few individual farmers, there has been little more than exploratory attempts to provide a farm weighing service by various bodies. Steps are being taken by the National Cattle Breeders Association to stimulate beef recording on a national scale.

A farm weighing service performs two principal services. The first is to commercial breeders so that they may have a check on husbandry factors, and the second is to pedigree breeders so that they have a means of performance and progeny testing on a farm. The first category of farmers can of course contribute to the breeder's function where there are store stock by known sires. Because the number of pure-bred females is so small in the majority of beef herds, much of the organized progeny testing will have to be based on matings with non-pedigree stock.

In addition to farm recording we believe that it is necessary to set up central performance test stations for bulls, and especially for those that are candidates for use in pedigree herds or for artificial insemination. Because of the small size of so many herds, on-farm performance tests for bulls have a limited application. Furthermore, the central station can provide authenticated figures, not only for liveweight gains but also for economy of food use, which are obtained under standard conditions.

Performance testing of beef bulls is being carried out on a pilot scale by the Ministry of Agriculture at Rosemaund, by B.O.C.M. Ltd., and by the North of Scotland College of Agriculture. The English Milk Marketing Board has had small teams of Aberdeen Angus and Herefords under performance test prior to their being progeny tested.

These tests are of great value in promoting the technique, but they are not on a sufficient scale to provide an adequate service for breeders. Furthermore, they suffer because of lack of standardization of methods. In at least one of them there is reason to believe that pre-test environment may be affecting the rating of bulls. The panel considers that there should be a considerable tidying up of procedure for performance testing before a national scheme is established. Whether tests should be based on a standard age or a standard weight range can only be determined by further investigation. It is considered that there is a need also to determine the optimum stage for completing tests. If they extend only to twelve months of age there is a danger that selection may be for bulls that will breed stores that do not reflect their sires' apparent superiority through to the more usual slaughter ages of eighteen to twenty-seven months.

We hope that the example of the R.A.S.E. to use its permanent showground site for performance test work will be followed by others; such sites could be available for ten month periods, ample for the pre-test and test period. Performance testing is in keeping with the aims of show societies, and would provide an effective means of publicizing its value to farmers, especially if show societies feature classes for performance tested stock. The possibility of such developments underline the importance of having sound performance testing procedure, appropriate to the various breeds.

The panel is unable to put an estimate of the scale of performance testing

that should be attempted, but if American developments in this field are any guide then not less than 300 bulls should be tested annually in each of the more popular breeds.

Performance testing constitutes only a first screening of potential sires for use in pedigree herds or for large-scale use by artificial insemination for commercial beef production. The ultimate estimate is by progeny testing, which will reveal the transmission of weakly inherited characters and those which cannot be accurately assessed in the living animal. Some progeny testing of beef bulls is now being undertaken in Britain by the English Milk Marketing Board, the Reading Cattle Breeding Centre, and the Ministry of Agriculture. Bulls from the North of Scotland and B.O.C.M. tests are being progeny tested by rearing crossbred progeny from dairy breeds.

These developments are heartening but the present scope and scale of operations does not answer all our needs and has not yet provided a certain foundation for further work. There are still the outstanding questions of what constitutes carcass quality and how this can satisfactorily be measured. Each group concerned with progeny testing is hampered because carcass assessment is still so ill defined. There must be reliable and standard appraisal procedures if the full value of progeny testing is to be obtained. Indeed, without these there is little point in progeny testing. On the assumption that these points will be resolved, the panel recommends that progeny testing should be organized on a basis of contemporary comparisons on farms as well as centralized stations. The latter system is more expensive and it will not cover a range of environments and weights and ages at slaughter, but it will be superior where there is a need to control environments or to undertake precise carcass studies. The main problem will be one of ensuring accurate identification of stock, but this can be resolved as it has been in the dairy industry.

PERFORMANCE AND PROGENY TESTING ABROAD

Performance testing, using Herefords, was pioneered at the Montana Range Experiment Station some twenty-five years ago. Now thirty-five State experiment stations in the United States and Canada are actively involved in regional beef cattle projects, and all of them carry on performance tests with bulls. These are mainly station bred, and 600-800 are tested annually. The work of these stations is primarily directed towards the development of methods that can be applied by breeders. That these are being applied is reflected by the following figures for 1961.

Performance testing was being practised by 4,204 breeders owning 308,641 cows with an average herd size of seventy-three. There were thirty-five testing stations handling 2,491 bulls, and in addition 12,621 bulls were performance tested on farms. 191 breeders were collecting carcass data on progeny.

During the past few months both the American Angus and Hereford societies have inaugurated progeny test programmes to supplement performance testing. Prices at sales of performance tested bulls from experiment stations are influenced by daily gain and conformation score ratings.

Performance testing has now been started in Argentina. There are two official performance test stations, one for Zebu bulls and another for temperate breeds. There can be no doubt but that in the foreseeable future leading Argentine breeders will be greatly concerned with weight gain data.

New Zealand's principal agricultural research station has secured the

cooperation of leading breeders to test forty bulls over the past four years in order to obtain experience of these techniques under grassland conditions. Here again there is a manifestation of interest in weight-for-age in a country which has been a regular customer for British beef cattle. This New Zealand work has already produced an interesting result, namely that the progeny of fast growing bulls have a lower fat cover, larger eye muscles and longer carcasses than those of slow growing bulls as well as two months advantage in age of slaughter at standard weights.

A NATIONAL AUTHORITY FOR BEEF IMPROVEMENT

The beef industry suffers because it has no organization with a comprehensive responsibility for its problems. Breed societies are not a substitute for such a body because their prime responsibility is the interests of their members, who are breeders of pedigree cattle. While accepting that the work of the societies is of the greatest concern to the industry, the panel considers that there is a need for an authority which represents the industry as a whole with the power and the money to provide the services the industry requires. Finance for a beef authority, it is suggested, should be provided by levy on all slaughtered cattle.

The functions of the authority would, in our context, be as follows:

- a. development of on-farm beef recording for both commercial and pedigree beef producers,
- b. organization of bull performance testing at central stations,
- c. conduct of progeny tests, independently and in association with authorities controlling artificial insemination,
- d. processing and interpreting data collected from the above activities,
- e. assessment of the industry problems and the provision of funds for necessary research.

In addition to breeding it would also be concerned with the broader aspects of production problems, review of grading methods, promotion of beef sales, market intelligence and similar matters of concern to the industry.

It is not suggested that the authority should in any way supersede the functions of breed societies which would be represented in its membership. It would strengthen them by the provision of performance data and similar records essential for an objective assessment of breeding stock. Though some breed societies have already started herd recording for their members, the panel's view is that the main cost of this service should be borne by the industry as a whole. The present activities of breed societies are limited to pedigree cattle, but it is essential to record commercial stock because much of the progeny testing especially can only be undertaken with commercial animals.

It is not suggested that the authority would set up its own research organization. Except in respect of statistical material, its purposes would be achieved most economically by using existing research institutes and schools and colleges of agriculture.

ARTIFICIAL INSEMINATION IN THE BEEF INDUSTRY

Apart from the use of beef bulls on dairy cows, artificial insemination is not widely used in the beef industry. Natural service is much more convenient under the extensive conditions normally associated with single suckling herds, and it is highly unlikely that such farmers would change to artificial insemination.

Except on an in-herd basis, where there are exceptional grounds for using artificial insemination, this form of service for pedigree cattle is not permitted by breed societies. The panel appreciates the reasons for this objection but nevertheless would like the societies to re-examine the part that artificial insemination can play in breed improvement in the light of the example provided by the dairy industry. The characteristically small size of pedigree beef herds does not allow the necessary intensity of selection for cattle populations that have already achieved a high level of merit.

Artificial insemination could have a two-fold part to play in beef cattle improvement, first, as a means of facilitating progeny tests, on a basis of contemporary comparisons, of a relatively large number of bulls which are used on commercial as well as pedigree cows, and second, by facilitating co-operative breeding by groups of farmers.

The breeders' objection to a loss of income from the sale of bulls could be off-set if royalty payments to breeders were instituted in respect of proven sires, including those used for commercial beef production as well as for pedigree breeding. Those services of a bull that are required for his proving would not earn royalties which would be payable only when a bull had been adjudged to be suitable for widespread use by virtue of his performance and progeny tests.

It is considered that such an arrangement would be more than a means of safeguarding the income of successful breeders and of giving them a fair reward for their work. It would be an encouragement towards selection for characters of economic importance to commercial producers. It is not suggested that all bulls would pass out of private ownership and become the property of artificial insemination organizations; there could be groups of breeders working in association in the manner adopted by the breeders who constitute Cattle Breeders Services.

This example has much to commend it. In the first instance it is the answer of some private breeders to the threat to their livelihood if there was a central organization which dominated the breeding of pedigree cattle. Secondly it provides a continuity in breeding policy which so often comes to an end with the death of individual owners. Thirdly, it is an additional safeguard against any danger there may be of concentrating on a limited number of blood lines.

This last point introduces an objection many breeders make when A.I. is discussed but the dangers of intensive in-breeding are not confined to A.I. They are also present under conditions of natural service, especially in breeds which are numerically small and where there is widespread use of the sons of a few outstanding sires. This advocacy of A.I. is contingent on the sorting out of a number of outstanding sires of different blood lines and the exercise of normal discretion by breeders who would continue to be completely free agents in the choice of sires. If artificial insemination is regarded as a tool and not as a master then it can be a potent integrating measure to secure the true objective of pedigree breeders, namely the supply of bulls which will improve the commercial qualities of slaughter cattle.

PROBLEMS FOR INVESTIGATION

A considerable amount of research and development work relating to beef production is in progress. The most notable projects, so far as beef breeding is concerned, are the three pilot tests undertaken by the North of Scotland College of Agriculture, by B.O.C.M. and by the Ministry of Agriculture. In

addition, a co-ordinated long-term trial, now nearing its completion, attempts to establish among other things whether there are appreciable heritable differences between Friesian sires in respect of beef qualities and whether there is any conflict between beef and dairy qualities in this breed. It is rather ironic that this, the largest beef progeny test ever undertaken in this country, covering some seventy sires, should be concerned with what is primarily a dairy breed. Nevertheless it has provided considerable experience in technique of progeny testing involving collaboration between a number of centres, and has pinpointed a number of outstanding problems.

Foremost among these appears to be the need for some precise measure of carcass quality. Ministry grading is not a satisfactory measure, for though it is correlated with fat cover there appears to be little relationship between grade and muscle content. It is essential that complete half-carcass dissections should be undertaken for several weight categories of beef animals and that the results of these should be related to a variety of simply obtained carcass measurements in order to ascertain which of these are the best indications of carcass value. We cannot hope for satisfactory progress in carcass improvement unless there is a precise definition of what is wanted and objective measures are obtained for the traits involved.

We must know much more about the technique of performance and progeny testing. For instance, will intensive feeding of progeny groups result in the same ranking for sires as that obtained under grazing conditions with a store period? Ideally this work should be done with identical twins.

We do not know whether a progeny test based on cross-breds will reflect the results that would be obtained if the progeny test was undertaken with purebred stock.

There is a need for investigations of hybrid vigour in crosses between beef breeds as well as crosses between beef and dual purpose and dairy breeds. The results of these crosses must be very carefully interpreted because there may be interactions with the environments to which they are subjected. There is very little known not only of the performance of crosses but also of the performance of purebred steers over a range of management conditions to reveal the size and quality of carcass each can produce as well as their efficiency of production. Such information is basic if breed societies are to define their objectives with any precision.

There is also a need to ascertain the relationship between type, as assessed on the living animal, with carcass attributes to help answer the question whether there is a need for a breeder's type of bull as distinct from a crossing type or should one type be the objective of breeders. Again, we have to know whether the selection of fast growing cattle is likely to be to the detriment of carcass quality.

There is also a need to determine in the principal breeds heritability values for and the genetic correlations between, the more important traits.

These are some examples of the type of problems that must be resolved before the industry can develop a confident approach to its breeding programmes. A considerable extension of existing research and the use of greater resources will unquestionably be involved. This will be expensive, and it is suggested that publicly-owned herds such as those at colleges and farm institutes should be used as much as possible in this work. Such an arrangement is a further argument for a central co-ordinating authority whose only concern is the welfare of the beef industry.

CONCLUSION

Some of the advocacies in this paper reflect a considerable change from conventional attitudes to beef breeding. Particularly is this so in respect of the suggestion that groups of breeders should pool their resources in a co-ordinated breeding plan in order to get the advantages of numbers. In the short term this course of action may be controversial, but we have no doubts about an ultimate recognition of its validity. The examples of both plant and animal breeding point to the necessity for large numbers to increase the chances of success. They point also to the wisdom of a close collaboration between breeders and geneticists. This collaboration is bound to grow, as it has in the breeding of dairy cattle, with the growth of recording because records give the breeder and the geneticist common ground and are a means of breaking away from empiricism. None of these suggestions denies the importance of the part the individual breeder has to play. The aim must primarily be one of providing him with factual material which will give him a more reliable basis for making his decisions and of providing a convenient mechanism for collaborative work.

Our prime consideration, of course, has not been the short-term financial interests of beef breeders but of the competitive status of our British beef breeds in the pattern of land use. If we cannot make the necessary progress, will some other breed become dominant in twenty-five years time, not only in this country but also abroad? The long-term interests of commercial beef production and those of the pedigree breeder are inseparable. Our advocacy for a concerted attempt to improve economic characters by applying established principles of population genetics is in essence an endeavour to safeguard the interests of breeders' pedigree beef cattle.

Discussion on the Report of the Beef Panel

MR. E. L. JONES: (*M.A.F.F.*). There are three points I would put to professor Cooper and his Panel: firstly, there is a suggestion in the Report that the sire performance tests so far carried out have suffered from lack of standardization but it may be that these tests have, in fact, benefited greatly from the lack of a standardized method. We can be quite clear that no one of these tests has been perfect but, nonetheless, I think that, because various techniques have been adopted, the difficulties that are involved have been highlighted.

PROF. COOPER: There are, of course, differences in technique between the various stations concerned and, in particular, bulls are going into the stations at different stages of development according to their pre-feeding. If I were to put a bull into a performance test and wanted to make a big show I would not enter it in very good condition. Unless you have got pre-environment details

you may be doing a lot of work for nothing because you cannot correlate the results. If the R.A.S.E. is going to do performance testing they should stop and think how it is to be done. They should not make breeds compete against one another in the same environment; the animals should be tested in their own environment because they may be designed for different purposes.

MR. JONES: My second point is to make a plea, if and when testing techniques are sufficiently tidied up, that there is a lot to be said for what I would call satellite testing stations with or without a relationship to a central testing station.

My third point is that I think we shall be open to criticism if we allow to fade away the tested material that is now in existence. Many bulls that have been through tests are still alive and actively at work. It seems to me a shame that this tested material should not be considered for use in further experimental work. I feel pretty confident that there are at least six performance tested bulls at work in A.I. centres and we ought to be very well advanced with plans for making use of these tested bulls before they pass out of control.

PROF. COOPER: I could not agree with you more; the last thing we want to do with any form of recording is to accumulate records simply because it is fashionable to do so. We must keep records and we must use them in a sensible and constructive way.

MR. SALISBURY: (*Messrs. Sainsbury's*). First of all I am sure that it is the hope of everybody here that co-operation should not only be the keynote of this Conference but the outcome of it. My firm, Sainsbury's, are able, on the retail side, to keep closely in touch with a significant sample of consumer reaction in London and the south-east of England and I would like to say right away that if at any time we can be of any help to Professor Cooper we are at his disposal. The question one sees raised so regularly today is "what is quality?" I think quality in itself is fairly stable but, of course, the remuneration which quality attracts is not stable but is subject to supply and demand. It is possible to test the current rating of quality simply by looking at the market prices of meat at any given time and I feel that people may subconsciously, when discussing quality, be discussing, in fact, what is going to attract the best price. The other topical question is whether or not the consumer will want young beef. I am sure that there is a future both for young beef and for mature beef and I am satisfied that, subject to reasonable price variations, there is a market for both of them on a very large scale.

PROF. COOPER: Briefly, I would say that in regard to age and degree of fatness the question is not one of breeding but of management. In our aim for quality the thing that we want to go for above all is the economic production of muscle. It is the stage of growth and management that will determine very largely the amount of fat and flavour that the meat will have.

MR. J. H. EVERALL: (*Shrewsbury*). I would like to say, firstly, what an admirable paper this is; all of us will agree with the objectives and a lot of us will agree with the difficulty of getting there. The important point is to find out what is going to be the most effective and quickest way of improving the beef cattle stocks in this country. Is A.I. going to be of considerable benefit? The A.I. movement has undoubtedly done some very good things. First, it has done a great job in helping the smaller man to save the expense of keeping a

bull. A tremendous amount of data has been accumulated. What is going to be done with it all I am not quite sure, but the crux of the whole matter is—"Have they improved the beef cattle stocks of this country?"

MR. R. LAIRD: (*West of Scotland*). I would like to put a plea to those beef breeders who will have something to do with the setting up of such a fellowship or authority as Professor Cooper suggests. This is for on-the-farm testing rather than central station tests. Such tests mean a great deal more to the breeder than a test done at a station in that he has a direct interest all the time in the test on his farm. It is most important to record the weight of the calf at weaning time since many farms rely for income on the sale of weaned calves and it is very important to find out those dams which are rearing heavy calves. We have found, from our studies, that there is a useful repeatability of calf weight from one year to another out of the same dam. This must not, of course, be taken in isolation. We must consider conformation; in some herds we have found a positive correlation between conformation and weight gain, in others it has been negative. But both these points should be taken into consideration.

PROF. COOPER: I don't think that there is any idea in the Panel's mind of dealing with any point in isolation. The idea of central performance testing stations is as a kind of shop window. Pedigree breeders are testing under their own conditions and would like to know how their work compares with others. A good performance testing station is the best possible shop window for our export trade.

DR. T. R. PRESTON: (*Rowett*). The suggestion of having a central authority must be considered very carefully because this is the first time that farmers will be asked to contribute to improvements in livestock production and let us remember that it is going to be the fatteners who are to pay the money. Let us not forget that in the last decade, and in the next, 90 per cent of improvement in livestock production will come about through better feeding and management and not more than one-tenth will accrue from better breeding. I suggest that a lot more emphasis must go on nutrition and methods of feeding, associated with improved breeding methods and we must rate these objectives in the correct proportion. Perhaps Prof. Cooper would indicate the order in which his proposed Authority should approach its objectives.

PROF. COOPER: Both sides must be dealt with together. I think we delude ourselves if we think that we are going to get spectacular results; it is the small, indiscernible, changes in each generation that matter and which perhaps in forty years or so, may add up to a whole lot, but we just cannot mark time on breeding until we get the management and environment correct. The two things have got to come out together.

MR. R. B. LITTLE: (*B.O.C.M.*). Would it be possible to use the huge cattle stocks over in the New World for testing our British beef bulls? Could we offer commercial breeders over there beef bulls used through A.I. stations so that the breeders could see for themselves how the animals perform in terms of liveweight gain and weaning weight? If we want big numbers of beef cattle tested this seems to be the only place where it can be done.

PROF. COOPER: There is undoubtedly a difficulty of getting big numbers in this country and it is a question of using A.I. It is pretty well impossible on a

big estancia to adopt A.I. I know that some people are doing it, particularly with Santa Gertrudis, but it has the air of a military operation and a tremendous amount of money is being spent on it. To do anything equivalent with our British breeds would again take a lot of money. Perhaps the profits of Mr. Little's company . . . ?

A speaker from Scotland suggested that all calves should be marked at birth in some uniform way so that their life history can be followed and *a speaker from Wales* referred to a meeting between the Royal Welsh Society and the R.A.S.E. to discuss stock classes at shows.

MR. MACDONALD: (*M.M.B.*) I would like to reassure Mr. Jones about the use of performance tested bulls in A.I. We have many more than half a dozen tested bulls at our centres and yesterday Dr. Edwards told how we performance-test not only beef bulls but also Friesian bulls. But we are not only interested in performance figures; what we want is a combination of performance figures and conformation. We would have many more bulls of this kind in our stud if there were breeders who were performance testing but at present we purchase as many as we can from men who have records.

The question of royalties was mentioned by Professor Cooper in terms of progeny recorded sires. Perhaps Professor Cooper would confirm this.

PROF. COOPER: Yes, when it comes to the point that the M.M.B. regard a bull as being a winner and use him on a very large scale, the man responsible for the breeding ought to have some recompense. We have got to realize that there is unfortunately a very strong feeling that A.I. is destroying the pedigree breeder. Can we make A.I. support and enlarge the pedigree breeder's work, give him new ideals and a new sense of purpose? If we look at it from that point of view it may be to the good of everyone concerned.

MR. MACDONALD: We are trying to find some common ground on which we may purchase bulls and at the same time satisfy pedigree breeders, but perhaps because many of the purchases are made by private negotiation there may be some ignorance on how the M.M.B. buys bulls.

We purchase progeny recorded sires for our dairy stud and we try to meet the breeder in every way possible. A bull can be hired, he can be taken on at the centre for a trial period, he can be purchased outright, or he can be purchased outright with following payments in further years if the bull is still in use. I doubt if these methods are generally known, and also a breeder who sells a bull to us can have an agreed number of inseminations. These are the methods the Board uses and I think they go a long way towards giving the breeders the kind of incentive they want.

Last year it was possible to purchase seventy-five progeny recorded sires in the dairy breeds.

MR. J. YOUNG: (*Norfolk*). As a member of the Beef Panel I would like to assure all breeders here that we approached this problem in the interests of pedigree breeders to try and determine and bring to the surface the issues which we believe to be vital to the future of the pedigree beef industry.

MR. G. SYKES: (*R.A.S.E.*). As I have to some extent been responsible for the proposed testing scheme at Stoneleigh I would like to assure breeders of our intention. First of all, Mr. E. L. Jones will give us the benefit of his great experience at Rosemaund. Secondly, we have a committee of capable farmers responsible for running the centre and thirdly we have taken care to engage

very experienced lahour. I must say that I feel a great sympathy for the pedigree breeder who sees somebody else getting the benefit of a bull which he has bred. At the present moment there is talk of seed breeders obtaining rights over their introductions; could not the pedigree breeder be protected in the same way?

MR. S. BAWTREE: (*N.C.B.A.*). I would like to mention one point that Professor Cooper emphasized and that is bull licensing. The National Cattle Breeder's Association has put considerable pressure on to the Ministry to get written into a Bill that is shortly to go before Parliament a clause that will permit the Minister to take action to improve the existing Bull Licensing Scheme. I am pleased to see that Professor Cooper's Panel thinks that this is vitally essential and I hope that this Conference will maintain pressure to make sure that action is taken.

PROF. COOPER: The whole purpose of the meeting is that these sort of issues can be aired and I think that Mr. W. E. Jones and Dr. Sanders have both got the feeling of the meeting on this point and on many others.

MR. A. BIGGAR: (*Castle Douglas*). As a member of the Panel I would like to comment briefly on one or two points that have been raised. First of all, Dr. Preston very rightly pointed out that this envisaged Authority would be financed by the industry as a whole and I think it should be emphasized that it is the industry as a whole which is going to benefit from the results of any information that is obtained by this Authority, not only on improvements in breeding but on improvements in management. With regard to the suggestion from B.O.C.M. as to whether bulls could be progeny tested in the New World there is a political difficulty here. What about the breeders of bulls in the New World who want to sell their own bulls and who provide a great deal of the incentive to the improvement of beef cattle in this country? Finally, while commanding the Royal Society on its proposal to establish a bull testing station at Stoneleigh Abbey I would ask them to remember that the different breeds of beef cattle in this country have got vastly different functions to perform and to consider well the point that the same kind of tests are not applicable to each breed.

The Chairman closed the meeting by expressing the thanks of the company to Professor Cooper and his Panel.

Report of the Dairy Cattle Panel

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I SHOULD like to make it clear that what I have to say is not the result of original thought on my part; it is a report of the deliberations of a team. I take full responsibility for putting our report together and, of course, for any personal bias which the words used in it may contain; but, unless where it is indicated to the contrary, the views stated are common to all of us. You may perhaps think it is significant that five persons, of such very diverse interests in dairy cattle breeding—including an eminent geneticist and a successful breeder—can find so much on which to agree!

As chairman of the symposium, I should like to pay tribute to the unfailing helpfulness and good humour of my four colleagues; indeed, I commend them to you as most knowledgeable experts who did most of the work and are, therefore, entitled to a correspondingly rich measure of your thanks! My gratitude to them is heavily weighted in the case of Mr. Longrigg, who acted as our convener and secretary and who was a tower of strength throughout.

A word of explanation is, perhaps, due to the farmers and others from Scotland who are in the audience. Because this Conference is of National Agricultural Advisory Service parentage and is being held in the North of England and because the limited time at our disposal demands brevity, we have reported mainly in terms of the scene in England and Wales; in particular, the statistics quoted refer to South of the Border unless the contrary is made clear. But we have no reason to think that the sense of what we have to say is (subject to local adaptation) of any less validity in Scotland.

THE PRESENT POSITION

Thanks to the Milk Marketing Boards, the Agricultural Departments and the commendable zeal of agricultural economists, dairy farming is well documented statistically. We did not, therefore, feel it necessary to prepare a lengthy historical statement of facts and figures.

The national herd of England and Wales comprised, in 1962, some 4 million cows in milk and cows and heifers in calf, of which roughly $3\frac{1}{2}$ million were of dairy type. There are now about 115,000 milk producers of whom the average herd consists of twenty-four cows in milk giving about 780 gallons each.

Massive changes in the breed structure of the national dairy herd continue to take place. Between 1955 and 1960, the British Friesian continued to increase and now constitutes just over 50 per cent of the whole; the Ayrshires and the Channel Island Breeds have remained fairly static, and the proportion of Dairy Shorthorn—now about 14 per cent—suffered another sharp fall in numerical importance.

The position of the breeds is also brought out by the bull licensing figures which show that the British Friesian is the only dairy breed of which, since 1955, the number of bulls in use has been maintained in spite of the rapid growth of A.I. On the other hand, since 1935, the number of licensed Dairy Shorthorns has dropped from a little over 20,000 to a little over 1,000, largely accounting for the fact that the total number of dairy and dual-purpose licensed bulls has dropped by nearly 18,000 (which is about 56 per cent of the 1935 figure).

About 700,000 cows are recorded in the N.M.R., their yield being about 100 gallons higher than the national average. (Of these cows, about half are registered and the remainder "non-pedigree".) If the cows recorded in the P.M.R. are added to the 700,000 on the N.M.R., it emerges that about one-third of the national dairy herd is milk-recorded under the Milk Marketing Board schemes. Leaving aside the obvious reasons why a much higher proportion of farmers should—as a personal aid to better feeding and breeding—record (purely domestic recording is seldom either sufficiently accurately done or adequately interpreted), it is interesting to speculate if the recording of one-third of dairy cows is an adequate base for national herd improvement, remembering that the statistics also reveal that only 45 per cent of nationally-recorded cows are subjected to artificial insemination.

Incidentally, the dwindling number of Dairy Shorthorn breeders use A.I. only about half as much as do, say, the owners of British Friesians, thus intensifying the improvement problems of a breed which, in this sense, is now getting thin on the ground.

The main attraction of increasing the number of cows which are milk-recorded is that it might increase the potential supply of proven bulls. As against this, such an increase would be (as we shall see) expensive to the industry. We think that, on balance, the recording of one-third of the national herd should suffice but we would deplore any reduction in this number.

The extent to which the industry is already using the production information at its disposal is impressive and entitled to more credit than the critics usually allow. In the past twelve months, the number of new contemporary comparisons (with ten or more daughter-records) calculated by the Bureau of Records was 1,027 while, in the same period, an additional 1,619 comparisons were revised to take account of further records which had become available. These figures include both A.I. and natural service progeny. (Unfortunately, about 80 per cent of the bulls tested were already dead) To these tests, the Red Polls, the Jerseys and the Friesians, in that order, made the major contributions in terms of numbers of bulls.

Finally, the extent to which the whole picture is now over-hung by the operation of artificial insemination is remarkable; in the year ended 31 March 1962 over 2 million cows—about two-thirds of the national herd in England and Wales—were inseminated artificially. Only Denmark and Holland use A.I. to a greater extent than does England and Wales. The Milk Marketing Board, provided inseminations from about 900 bulls of 18 breeds. In 1960, artificial insemination was used in 63 per cent of the dairy herds as the sole method of breeding while only 13 per cent used natural service only. It is an interesting fact that about 10 per cent of inseminations are carried out on pedigree and "grading-up" cows and 90 per cent on non-registered cows; A.I. is clearly the tool of the milk-producer rather than that of the pedigree breeder.

THE LONG-TERM AIMS OF DAIRY CATTLE BREEDING POLICY

Owing to the complexities of British dairy farming, it is not easy to set out a long-term breeding policy for dairy cattle in the form of a neat, self-contained list of objectives. Nevertheless, some such statement is required and we believe that the following are the major essentials:

- a. The breeding policy required—national and individual—must provide dairy herds which are consistently capable of producing yields of milk, of composition acceptable to the consumer, at costs of production which make milk production reasonably profitable for the dairy farmer. (Some would be disposed to add efficiency of food conversion to this list but this is unnecessary if one accepts that high yield must be accompanied by good conversion.) I have glibly used the phrase "acceptable to the consumer" but little precise information is available. It would be a great boon to all breeders to be given "a guiding light" as to what the consumer really wants. Is high fat wanted or is S.N.F. the thing? Is standardization of milk for liquid consumption a possibility in Britain?
- b. In particular, the cows resulting from this policy should have the following attributes:
 - i. ability to produce offspring which are potentially at least as good, in terms of yield, as themselves;
 - ii. high fertility leading to a regular calving interval not exceeding twelve to thirteen months;
 - iii. docility and adaptability to modern methods of housing and milking;
 - iv. good health and longevity; and
 - v. fast milking.
- c. "Beef from the dairy herd"—whether as pure or cross-bred offspring or as cast cows—is of immense importance for the following reasons:
 - i. by-product beef—whether offspring or cast cow—is an important potential source of income to the dairy farmer and is, therefore, a factor which may reduce the cost of production of milk; and
 - ii. there is no substitute in sight—whether home-produced or imported—for the large proportion (about 60 per cent) of home-produced beef which comes from the dairy herd.

It follows that a large proportion of the cows kept in Britain must be capable of producing pure or cross-bred calves which are suitable for the beef producer. This state of affairs cannot be achieved just by hoping that high-yielding milk cows may, by good luck, possess such desirable qualities; it means that due regard must be given, when selecting bulls and cows, to their beefing properties, weight for age, and size. Dr. Mason has been engaged in an important investigation of the relationship between beefing quality and milk production in Friesians and it is reasonable to hope that the results will, in due course, throw light on this involved question. In the meantime, the consensus is that there is probably a degree of incompatibility *within a given breed or strain*, between beefing-propensity—not to be confused with growth rate *per se*—and milk yield. Insistence on beefing qualities in the cow *may*, therefore, have an adverse effect on the economics of milk production. This, in turn, means that difficult farm management decisions—between potential income from beef and from milk—are involved.

Any statement of fundamental aims leads on naturally to the question of

dairy breeds. Do the breeds now existing in Britain contain a sufficiently wide variation of genetic material for improvement purposes? Alternatively, is it essential to have an open mind on imports of dairy cattle (or semen) to this country? Are some of the dairy breeds which we already have in Britain unnecessary or even undesirable?

The dairy cattle panel have not attempted to delve too deeply into this big subject but the following thoughts are, however, offered to the Conference. What has already been said on long-term aims suggests three main breed requirements, viz:

- a. milk-producing animals of large capacity and high efficiency for converting grass (and its conservation products) into milk while also offering considerable beef potential;
- b. smaller animals more suited to land of intermediate or lower quality; and
- c. breeds which cater for what might be called the connoisseur demand for milk of high chemical quality.

Without mentioning any actual names, we think that the breeds which meet these three demands will be obvious! No doubt, British breeders will gradually make their plans in accordance with these principles.

If we accept these views, it follows that the dairy farmer who is concerned wholly or mainly with milk production tends to be faced with a rather complicating choice from an unnecessarily large number of breeds. But, even if this be true, there is no resulting detriment to long-term dairy cattle improvement because the varied heritage of British breeds contains rich reserves of genes ready for exploitation as the economic need may arise. The words "economic need" are important. There is no substitute for the hard facts of this form of compulsion; we therefore see no place for an imposed national breeding policy —vis à vis breeds—as a substitute for the individual decisions of dairy farmers.

The size of breed population is relevant to the viability of any given breed i.e., viability for survival and viability for improvement within the breed itself. Any breed already in the former category must clearly be the concern of those with interests in zoology rather than for a conference on dairy cattle improvement. The problem of a breed hovering on the brink of being able to provide a sufficient base for improvement is, perhaps, a more open question but, on balance, it is difficult to see any case for trying to arrest artificially the processes of economic change.

No one, however, should be so starry-eyed as to assume that the dairy cattle of Britain must have a monopoly of the best genes available in the world! We therefore believe that the national policy on imports should be as liberal as possible, subject only to adequate precaution being taken against the importation of serious diseases not already found in Britain. After all, livestock farming is subject to some degree of disease risk and there is no case for applying unnaturally rigorous standards to imported animals.

Where imported "blood" is subsequently to be used in the *national A.I.* services, it is right for the Government to have the final say; in this case, the consequences are potentially too widespread to be a matter for private or sectional interests. But maximum freedom should be left to private breeders, subject to health safeguards, to back their own judgment (at what is, after all, their own risk) when deciding whether to import or not. We regard with some suspicion a national policy which seems consciously directed towards making importation of breeding dairy cattle very difficult. This policy gives the Breed

Society most directly concerned something which amounts to the last word in the control of importations within its own breed. And it seems to be based on the philosophy that the introduction, to this country, of a "foreign breed" is the ultimate horror.

PROGENY TESTING

It is time for everyone concerned to accept the irrefutable evidence (which, incidentally, has been available for at least ten years) that milking performance i.e., yield and composition, food conversion efficiency and (apart, perhaps, from degrees of "family" likeness) even the physical characteristics, which a bull will transmit to any one of his progeny are not predictable. In other words, there is no known substitute for progeny testing.

Every breeder must know how true this is when he reflects on the sharply-differing results which may be obtained from bulls which are full brothers. For example, the M.M.B. had, at one time, a bull which *raised* production by 77 gallons per heifer sired by him while his *full* brother caused a *reduction* of 35 gallons from his heifers. The lack of predictability from individual matings provides the answer to the question sometimes asked: are too many "good" bulls slaughtered (or castrated) before their potential is known? Since the majority of bull calves must be either slaughtered or fattened, it is true enough that a great many potentially good sires are never used; but there is no advice which would prevent this loss by suggesting, in advance, whether any particular bull calf has specially valuable attributes. Equally, however, the chances are just as good that a sufficient number of the outstanding ones are retained!

It is important not to confuse the unpredictability of any one mating by an unproven bull with the opportunities which do exist to improve the chances of success from young bulls. Thus, an analysis by Dr. Robertson of the progeny tests of some 490 sires and of those of their 1,500 sons shows that sons of bulls with high contemporary comparisons are much more likely to earn high ratings for yield than are the sons of bulls not so qualified. A similar relationship exists for butter fat.

In this context, one uses the phrase "progeny testing" in a wide sense; it is not suggested that, in its present form, progeny testing necessarily covers a sufficiently wide range of important economic characters.

PROGENY TESTING USING ARTIFICIAL INSEMINATION

From what has been said, it follows that the active prosecution of progeny testing by every means possible must be the king-pin of national dairy cattle improvement. It is the key to "choice based on information" which is the very sound definition of livestock improvement used by Dr. Robertson. Is it to be station testing, or field testing based on the contemporary comparison, or both?

Especially for the two main economic factors—yield and composition—there can be no doubt, on present knowledge, that the best source of information is field testing, of which the hand-maiden is the A.I. service. The reason for this is, on the one hand, a function of the statistical reliability of the larger numbers used in the comparisons and, on the other, of the relative cheapness of the system. (Normally, the end-product of field testing is the contemporary comparison; but, if this is not attainable, at least there can be

the determination of the averages of all milk-recorded daughters.) It is sometimes forgotten that field inspections do include data on type. And, before long, attributes like speed of milking may be added to the recorded information. Undoubtedly, too, field testing will be strengthened when information on S.N.F. becomes generally available, in England and Wales, through the N.M.R. It is highly significant that the system of field testing, based on contemporary comparison (or something closely equivalent to it), is now in use in New Zealand, Sweden, Canada and parts of the United States.

By comparison, the station test suffers statistically from the tendency for insufficient animals to be available for an adequate and random sample from each sire and from the risk that the sheer visual simplicity and attractiveness of the spectacle may divert breeders from the more reliable facts of the field test.

On the other hand, the station test has been extremely fruitful of data on temperament, speed of milking, evenness of yield from fore and rear quarters, ease of milking, completeness of milking without stripping, and conformation. In this context, "conformation" includes those important outward signs (feet, hocks, udder attachment, etc.) which are generally accepted as indicative of good wearing ability. Station testing can also bring out those aspects of docility and behaviour which are so vital to the new labour-saving methods of dairy farming. For these reasons, station testing in Britain has undoubtedly educational value if it is wisely interpreted in the light of the greater reliability of the yield and composition data derived from field testing. The station tests have also served to give publicity to the value of the bulls shown to be outstanding by the other method. If any proof is needed of the value which breeders attach to testing at stations, one need only think of the popularity of Barby and Cathkin.

Having regard to these arguments, we do not think there is a case for providing, at public expense, a network of testing-stations on Danish lines. We do, however, commend the idea of station-testing in a rather different way viz. the bringing together, for a short period, of sample groups of progeny from carefully selected bulls which show high promise (through prior field testing) as soon as this can be measured from the performance of, say, thirty daughters. The object of these short "tests"—during which open house would be available to all interested breeders—is not to make yield and composition comparisons over a whole lactation (a purpose better left to field testing) but rather to concentrate on critical comparisons by breeders, on advisory work and on publicity. It seems to us that, viewed in this way, the idea of a number of regional centres up and down the country can be commended to Show Societies, selected N.A.A.S. Husbandry Farms and the Scottish Agricultural Colleges. The getting-together of the breeders and the scientists and the animals at this type of educational demonstration has had a potent influence for good in Denmark and Holland. Its potential should be exploited here; that this can be done was recently demonstrated by the success of the Milk Marketing Board's progeny exhibit at the "Off the Grass" Demonstration at Harrogate.

The "Five Hundred" scheme in England and Wales and its counterpart in Scotland for which the trail was blazed in 1953 by a pilot improvement project initiated by Cambridge Cattle Breeders Ltd. with financial support from the Agricultural Research Council are highly significant developments. I shall however, leave these schemes to the discussion session so that any questions

on them can be directed to those better qualified than I to answer them. (At that stage, you may perhaps spare a thought for the plight of any dairy breed now too thin on the ground to provide 500 inseminations for a given bull within a reasonable period of time.) In the meantime, I should like to mention the possible burden which these schemes may place on the shoulders of farmers who milk-record. It would be rather unfair if these milk-recording owners found themselves having to bear the main weight of inseminations from young un-proven bulls. Cambridge Cattle Breeders Ltd. have met this contingency by endeavouring to arrange that proven bulls and young bulls are used in roughly equal proportions in all herds, whether milk-recorded or not. In addition to the disadvantage that this may entail some restriction in the use of proven bulls, it may not be a feasible solution in "national" A.I. It looks, therefore, as if the whole business of who should pay for milk recording will become an important question and it is reassuring to hear that the Milk Marketing Board has under review the problem of apportioning the costs of recording between recording farmers and other farmers (and, indeed, the wider issue of the changes which modern concepts of progeny testing may demand of milk recording).

THE PRIVATE BREEDER

The panel gave some thought to the contribution made by private breeders in this age of artificial insemination, computers and Milk Marketing Boards! That private breeders play a large and important role is beyond doubt; it is fanciful to imagine that Britain is remotely near a position in which dairy cattle breeding is in the hands of a few authoritarian bureaucrats. Private breeders still devote their individual ways of thinking to the problems of breeding and this counteracts any tendency towards the rigidity to which institutional thinking may be subject. There is some risk in countries in which A.I. is used on a universal scale of the disappearance of individual strains; diversity of breeding policies may impart a corresponding measure of safety. The private breeder is in a very strong position to observe physical characters and production-efficiency and behaviour and to substitute for any scientific shortcomings (which may be inherent in his small scale of operation) deep personal knowledge of his individual animals. In his hands, when backed by good judgment, even the now rather-decried within-herd daughter-dam comparison can be a valuable weapon. His Achilles Heel is a lingering over-emphasis of the importance of conformation, especially in the male, together with occasional failures to make enough use, while they are still alive, of bulls which are shown by the published facts to be outstanding; his main asset a tendency to persevere with a specific line of breeding designed to "fix" the economic characteristics most dear to him personally.

In our deliberations, we have contemplated "breeders" as falling into three or four categories, viz., the "creative" specialists; the users of the products of these specialists to shape the evolution of more ordinary breeding herds; the intelligent and selective user of A.I.; and the man who merely uses A.I. with little or no interest in the resulting calf except in so far as it is essential to promote a further period of milk secretion. (Obviously, the differences between these categories are of degree, the categories themselves not being sharply defined or mutually exclusive.)

The first two categories of breeders mentioned play a vital part in maintaining desirable concentrations of "blood" and are therefore important to the future of cattle breeding. It is, perhaps, not impossible to imagine the industry existing without them but, in their absence, some alternative form of nationalized provision would undoubtedly have to be instituted to perform an equivalent function. To say the least, it is unlikely that this alternative would, in the end, be as cheap or as efficient.

There is, however, a serious gap in the armoury of private breeders if they are seeking to stake a claim on the income of the industry viz. the almost complete lack of information on the economics of the production of pedigree stock, especially bulls. What capital is involved? What is the financial reward? What does a privately-tested bull cost to produce? It seems to us on the panel that breeders should make a concerted effort—even at some expense—to have these questions answered.

PURCHASE OF YOUNG BULLS FOR A.I.

There is immense interest, especially among breeders, in the prices currently obtainable for young bulls bought for A.I. and in the ways in which payment for these animals might be arranged. This is not to be wondered at. On the one hand, there seems to be little appreciation among milk producers of the extent to which the demand for young bulls is less than it would be but for the advent of A.I. On the other hand, the whole industry is vitally concerned that the supply of such bulls should continue on a long-term basis.

In essence, the prices paid for young un-proved bulls is as much the result of supply and demand as it ever was; all that has changed is that the situation has moved against the seller.

On the supply side, it is in the nature of things that there are far more dairy bulls available than are needed. To this circumstance has now been added the technological advance of A.I. (which has enormously increased the disparity in the numbers available and numbers required) and the growing realization that, within the pedigree world of British dairy breeds, the genes have become extraordinarily evenly dispersed. In other words genetic differences between pedigree herds are small; this must reduce the chances of any one calf turning out to be a "flier". Breeders will have to become reconciled to the effect of these facts of life on the value of young untried bulls. Any attempt to peg the prices of the relatively few bulls required for A.I. at levels which ignore the facts of the position would be to deny to the users—the majority—the financial advantages of technological progress. Obviously this could not be contemplated by a statutory body acting on behalf of all dairy farmers.

On the other hand, the users of A.I. (and those who act for them) must remember the value of the contribution made by private breeders (and the consequent desirability of keeping them in business) which I have already elaborated.

We can see no better system than allowing the price paid for young bulls for A.I. to be determined by the "haggle of the market" with each side playing its best cards to the fullest extent. There is, however, an additional amount of money which could be made available to breeders, viz., the profit made on the small minority of such bulls which ultimately prove themselves and are

then used massively over a long period. This, in turn, means that—from the same limited total of money available—the amount paid for a young bull might be *either* a once-and-for-all figure which reflects his relatively poor chance of proving to be a successful sire (being something a little above his value as an unknown quantity) *or* an initial payment restricted to his value as an "unknown" *plus* subsequent payments if and when he proves himself and becomes profitable to the A.I. service. The former method means that the subsequent profits—if any—accrue to the party who bears the cost of the proving and the latter that, while the initial price of the bull is more modest, a financial interest in the *chance* of having bred an outstanding bull is retained by the breeder to whom many would say the benefit ought to accrue.

We were not unanimous within the panel as to the relative merits of these two ways of paying for the replacement bulls of A.I. On the one hand, it is natural that breeders feel ill-used if they have no share in the high income from bulls which turn out to be very successful. On the other, the cost of proving a bull is heavy and it is, therefore, a respectable argument to say that the person who stands this cost, and takes the risk, should reap the benefit. It is too early to expect reliable figures on the cost of proving bulls from the national schemes but the panel was indebted to Dr. Robertson for some provisional financial data from the Cambridge Centre. So far, on the assumption that about one bull in six is worth bringing back to use as a proven sire, the cost of each such bull, provided it can be purchased initially at £500 or a little less, is about £2,000. This figure, however, benefits from substantial hiring fees and from the sale of proven bulls in a way which would not accrue in a national scheme; it also ignores the value of N.M.R. information to the project. Taking these corrections into account, there can be little doubt that proven bulls will cost milk producers, one way or another, of the order of £4,500 apiece.

For my own part, I favour the second method of payment provided it is realized that the total amount of money available is limited by the overall supply and demand position and that, therefore, there can only be choice as to the *method* of payment. My personal inclination is perhaps to be expected in that the Scottish Milk Marketing Board has chosen this method! The Scottish Board decided in February, 1961, to purchase acceptable young Ayrshire bulls at an initial price of £300 to which is added £100 if and when it is decided to retain the bull in A.I. *plus* a bonus on a sliding scale used on and payable when a given contemporary comparison is achieved. The Board pointed out by way of example that, had the scheme been in operation, one of the Ayrshire sires used in its A.I. service would have been purchased as a yearling for £300 and, five years later, would have earned for his breeder a further payment of £2,494 (i.e., £2,794 in all).

APPROVAL OF BULLS TO BE USED IN A.I.

The statutory authority of the Agricultural Departments to approve (or disapprove without stated reason) of bulls to be used in A.I. is also a subject of considerable current interest. This final sanction is applied after a long and vigorous chain of elimination (which includes veterinary examination) applied by the A.I. authorities with such single-minded purpose that an original short list of 150 potential bulls may easily be reduced to twenty. The latter, in turn,

may fade to three or four when the Government's disapproving eye is turned upon them!

There is no doubt about the absolute need to put only the best animals into A.I. but there is some feeling among those who give so lavishly of their time to inspection work that this final requirement leads to needless frustration of effort and confusion on the very eve of pedigree sales while being, at the same time, less likely to be well-founded because of what seems to be a lingering attachment to conformation considerations. My colleagues found it difficult to reach a unanimous view on this contention but I sensed among them a tendency to lean towards the view (which I support) that the A.I. authorities can be trusted to do their own selection. If the law is to remain as it is, however, confidence would be stimulated by an authoritative statement by the Government that a moderate failure by a bull in conformation can be outweighed if his production figures are very outstanding. No one wants short-comings in both conformation and performance to be excused but, since perfection is unattainable, there ought to be a certain degree of give and take in applying the standards. (For reasons which will be apparent, Mr. Longrigg does not commit himself or his Ministry to these views.)

THE DAIRY BREED SOCIETIES

It is interesting to speculate why so many farmers join Breed Societies, especially since a good many of them seldom, if ever, register animals! Is it merely the deep-seated British fondness for the Club idea, in this case a Club of which the members have common interests and deeply-held convictions? Is it, more probably, because membership is an economical way of having essential breeding records preserved in a form which carries acceptable authenticity? Or is it that the Societies give a great deal more advice than is generally recognized and thus enable breeders to be more successful?

It does seem that, in the case of some Societies at least, the main contribution in the past has lain in the registration side of the work and that their corporate contribution to new thinking has scarcely matched the manifest enlightenment of some of their individual members. There are, of course, notable exceptions to any such charge. A number of Societies have published production registers for many years; in the case of the Shorthorn Society these have included contemporary comparisons—a most useful refinement which should be copied more widely. The British Friesian Society has given a lead—in its type-classification scheme—to the study of the heritability of physical characters and their significance vis à vis yield and composition. And there are many other examples of equally beneficial activities.

Be all that as it may, there is at least no doubt that any Society which is energetic and forward-looking can play an important role in the future. It is alleged that too little attention has been given in the past to the part played by the female parent; here is a field of study which Breed Societies could take up. The Societies can also do a great deal to foster interest in progeny-testing and to get the resulting information more widely used; to (as one breeder puts it) "keep tabs on male lines"; to bring parties of farmers to the short-term station "tests" which have been described; and, in general, to do everything possible to prove that private breeders can make a contribution which is complementary to what is being done institutionally and nationally.

As everyone knows, there is a vital common interest, amongst all livestock farmers, in ensuring that as much information as possible is available on the occurrence of inherited harmful or lethal recessives. No one can reasonably expect this information to be published like some "Which?" of the livestock world! But it is very much in the national interest that the information should be available to such bodies as Milk Marketing Board, Scottish Milk Marketing Board, Ministry of Agriculture, Fisheries and Food and Department of Agriculture and Fisheries for Scotland, all of whom make decisions which affect so many breeders. Breed Societies could encourage their members to be frank on such matters so that the data is accumulated discreetly.

With so many opportunities for positive work offering, it is perhaps permissible for an outsider like myself to wonder why the decks are not cleared for action by the setting up of centralized and more economical facilities for the routine work of registration and publication.

RESEARCH

My own background is in a place concerned with teaching, research and advisory work (we do all three under one banner in the Scottish system) and no doubt it is this circumstance which constrains me to wind up by stressing the vital need for more and more research. And, in this context, I do not limit "research" to its institutional forms. In our talks in the panel, we all too frequently found ourselves brought up short by lack of reliable knowledge; it is not difficult to suggest the wide variety of work which needs to be done.

What is the value to milk production of cross breeding? Dr. Donald has been engaged in work on this problem and states that, while he finds no evidence that his cross-breds are superior to the mean of the parental breeds, there are some signs—as yet incompletely analysed—that they may be superior *vis à vis* mortality at first calving and fertility. Here is an important field for further work.

There has been some hope that blood groups (and other simple genetic factors) can be used in cattle improvement. Dr. Robertson considers that the balance of evidence is against these being important new tools but thinks that further study might reveal specific cases of the genes in question affecting important characteristics.

The deep-freeze techniques for handling semen are still imperfect but it is clear that the heritability of the production, by individual bulls, of semen which is suitable for deep-freezing demands more study.

Above all, the whole field of the physiology of milking capacity—and its heredity—is wide open for fundamental investigation. What makes one animal milk and another put on weight? What is the relationship of size to the efficiency of converting food into milk?

Finally, one of the greatest needs in Britain is for more facilities—perhaps particularly in Scotland where the College farms are used principally to demonstrate existing successful systems as a basis for teaching farm-management—to investigate, under commercial conditions, the application and economic implications of the fundamental findings of the Research Institutes.

My last remark is a personal thought stemming from my position as rapporteur of the panel. In all our deliberations, I could detect no gulf between scientist and breeder (or, indeed, any indication that the best breeders

are not considerable scientists!) beyond the honest exchange of views taken from legitimate but different standpoints. It is to be hoped that cattle men and scientists will go forward, profitably, in close consultation.

Discussion on the Report of the Dairy Panel

MR. J. R. CURRIE: (*Dartington*). I think Professor Hendrie was a little bit too sweeping in his conclusions regarding progeny testing. Certainly in relation to minority breeds where there may not be a large number of cows. If, of course, less than twenty heifers do not represent adequately the performance of the breed I agree progeny testing is very difficult. I would like also to suggest that speed of milking is one of the things that can be used in assessing the performance of cows. At Dartington we have been doing this type of work for over twenty-five years and there is a growing tendency to blame the cows for what may, in fact, be the faults of the milker. Another point which might be discussed is the input-output relationship, which is very important indeed. The period of lactation also varies greatly and should be considered. Further, in view of the importance of the dairy herd to our beef supplies we ought to consider whether or not food consumption and live-weight gain should be taken into account. I am not altogether happy that a short-term test for heifers is satisfactory, we found that 180 days gave a useful indication but think that ninety is too short.

PROFESSOR HENDRIE: On the subject of progeny testing we reported in favour of the field test because of the immense cost of setting up a national chain of stations.

CHAIRMAN: Would Mr. Hodges or Dr. Robertson like to say a word or two about reliability of speed of milking test and whether twenty daughters is a fair sample?

MR. J. H. HODGES: (*M.M.B.*). The Panel had a lot of discussion on this question of how many daughters should be tested; we felt that we would like to see the results from more than twenty before we decided that a bull was finally proven, but the costs that would arise if we took more than twenty decided us to recommend the field test. There is also a certain amount of evidence that if you are selecting on contemporary comparisons for milk yield you are in fact selecting at the same time animals that are efficient food converters. The added advantage that they are producing under a wide variety of commercial conditions seemed to us a further asset.

A speaker from the floor said that Professor Hendrie had made some disparaging remarks about the Dairy Shorthorn breed and referred to the

importance of the fact that this breed produces milk with a very high percentage of s.n.f.

PROFESSOR HENDRIE: I don't recollect saying anything against the Dairy Shorthorn as a breed; I was making the point that numbers are getting so small that it would be difficult to employ a modern progeny testing system for improvement. Certainly there is no desire on the part of the Panel to see this or any other breed disappear.

MR. J. S. MORREY: (*Wiltshire*). As I see it, the purpose of all livestock breeding and production is to convert animal food to human food. We seem to be running completely blind on this question of food conversion; accepting that quality in livestock is important what else is there to bother about but food conversion? Mr. Hodges suggested that the milk yield of a cow is an indication of her ability to convert food but I don't accept that. I turn my cows out as a group with an even chance to produce milk and under such conditions production varies fantastically. I am not convinced that it is the greedy cow that necessarily is the best food converter. It seems to me that research should be devoted to this factor because it opens up by far the biggest field in which to work. Animal breeders have no reliable yardstick for this conversion of food into flesh or milk and I think that this is a great hindrance to advancement in livestock breeding.

MR. HODGES: I agree with Mr. Morey that you cannot possibly measure the conversion efficiency of an individual cow simply by measuring her milk production. The point I was making was that in deciding which bull is capable of transmitting milk production and conversion efficiency there is a certain amount of theoretical evidence that a high contemporary comparison bull is likely, on average, to have daughters which are going to be more efficient converters on average than a lower contemporary comparison bull.

PROFESSOR HENDRIE: Five years ago I would have agreed with Mr. Morey that this was the important thing to do; at that time I acquired a lot of facts and suddenly realized that I was wasting my time. If you check data relating to cows being fed according to production you will find an extremely high connection between milk yield and efficiency of food conversion. At least under any system in which people adhere closely to rationing. The same factor arises under grazing conditions, according to work done in New Zealand. I believe, after having looked at the facts, that under any system if you pick the high yielding cow you pick also the best converter.

MR. LOFTHOUSE: (*Essex*). I cannot accept the two main points of this report. Firstly, that contemporary comparisons are the best means of selecting bulls, and secondly that you have to have a large number of daughters to prove a bull. To be constructive I suggest that A.I. has outgrown its original purpose of providing a service for small farmers, that it has become a very important means of cattle improvement, that it should be taken out of the hands of the Board and that a committee of scientists and breed society representatives should be set up.

MR. BOSTON: I would like to put in a plea for station testing as a follow-up to the contemporary comparison. If the contemporary comparison proves the bulls to the satisfaction of the "boffins" then the station test should be used to prove the bulls to the satisfaction of the breeders. Further, I would like to make a plea for the retention of local breeds. A lot of us feel that the genetic

reserve may be of great value in the future. Perhaps not in a pure breed but possibly in crossing and in the improvement of another breed. Lastly, I would like to see a better understanding and a better approach to the breeders by representatives of the A.I. centres. If the breeder is taken into the confidence of the people enquiring after a bull he could give a tremendous lot of help.

PROFESSOR HENDRIE: If a breed or breeder wants to run a station test, providing it can be made self supporting there is nothing against it. We merely tried to express a national opinion. Perhaps our suggestions for very short duration tests after going through the sieve of contemporary comparison might go some way to meet what you have in mind. As far as breeds in danger of disappearing are concerned we did not feel that this problem was in our terms of reference, but I personally feel that nothing but good could come from maintaining these breeds. It is a matter for the breeders themselves; we did not think that there could be a national case for doing this just in case of possible economic need at a later date. On this last point of public relations I have heard nothing in this room in these last two days which has sounded like a legitimate criticism of the M.M.B., in other words it may be that there is some failure in public relations.

PROFESSOR I. A. M. LUCAS: (*Bangor*). I would like to question Professor Hendrie on his proposed short duration test. It seems to me that to achieve quite limited objectives it runs into a number of severe snags:

- i. whether a limited number of animals provides a suitable sample,
- ii. high capital cost of providing buildings
- iii. the organizational difficulties of getting animals to and from the test for a short period.
- iv. unwillingness on the part of farmers to mix their animals because of disease risks.

Would it not be more practicable and cheaper to inspect a larger number of animals on the farms?

PROFESSOR HENDRIE: We agree that there are snags and we do not suggest a network of stations all over Britain. We thought that bodies like the Royal Agricultural Society might like to do it as part of their development work. Perhaps Mr. Hodges would like to say something about field inspections?

MR. HODGES: We do, in fact, inspect a large number of daughters of A.I. bulls when attempting to assess their progeny and although it works out at an average of perhaps twenty to twenty-five the Panels inspect as many as they feel they need in order to obtain a fair opinion. In some cases this goes up to as many as fifty, particularly with bulls which are coming back into extended use and who have second and third lactation daughters available. There is a case for milking rate to be measured under commercial conditions and it could add a lot to progeny testing.

One further comment on this question of short term progeny testing is that we were visualizing it more as a demonstration; not an occasion when a great deal of extra information was going to be obtained but an occasion when a bull which had already achieved some national prominence could be compared with other bulls. The difficulty of field trials is that you cannot put one group against another so as to get a visual impression of differences, and it was for this purpose that we really made the suggestion of a demonstration which might last for so short a time as only a day.

MR. C. W. SCOTT: (*Devon*). Much as I respect and admire the work of the M.M.B. I think that to get any useful work out of the pedigree breeder he must have the means to do it; what led to all this trouble between the M.M.B. and the pedigree breeder is that the A.I. service has cut away a source of income from the pedigree breeder that the sale of bulls used to bring. Some of that money must be got back to the breeder if he is going to make a useful contribution.

PROFESSOR HENDRIE: This is really a matter of supply and demand. I don't think pedigree breeders can expect to be kept in business at a higher level than their economic worth. This is not taking sides against them at all but I think the matter has to be settled on straight economic terms. There is no question of taking away something which already exists; if a man starts up in business knowing the risks and finds that it does not go quite so well as he expected, this is one of the hard facts of life.

Another questioner drew attention to the fact that after the approved breeder has gone through a very long process indeed and submitted to many tests and questions before a bull is approved he is faced at the end with what Professor Hendrie calls the Government's "disapproving eye". There is no need for this; it is frustrating to the Panel, and extremely frustrating to the breeder who has offered the bull. Would Professor Hendrie suggest abolishing this "eye" or could he suggest any alleviation of the present position?

PROFESSOR HENDRIE: The Panel would like to remove this "disapproving eye" at the end of the rigorous selection which has preceded it. We don't think that this reform would suddenly transform the livestock industry but we do say that it is a needless final complication.

MR. L. J. LAMBOURNE: (*New Zealand*). I would like to comment on two points. Firstly, the question of the survival of breeds which are represented by only small numbers of animals. It would be a great pity if the identity of some breeds were lost in a general and sweeping adoption of standardized tests.

We have examples from all over the world of breeds which are not highly esteemed in this country proving of great value elsewhere. For example, the Romney Marsh sheep in New Zealand; similarly, the most widely used dairy animal in Australia is the Shorthorn. These valuable reservoirs of genes should be maintained for future use. The second point is that in New Zealand any pedigree breeder whose bull is used by an A.I. service gains a tremendous publicity advantage. This benefit can be so great that it would almost pay the breeder to give his bull to the A.I. for the publicity.

PROFESSOR HENDRIE: The Panel felt that all breeds had valuable genes in them but they did not feel that there should be national action to prevent a breed from disappearing. If there are enough worthy people to keep the breeds going that is fine: I don't think that a breed goes out of existence because wrong criteria have been applied to it. The reasons are just economic.

MR. W. LONGRIGG: (*East Midlands*). I wish to comment on that rather ticklish question about Ministry follow-up on bulls selected for A.I. It was one of the very few points on which the Panel did not reach a unanimous opinion. We in the Ministry's livestock section look upon ourselves as an independent follow-up with no axe to grind and when one considers the very wide use of some of these bulls now stationed at A.I. we think that the extra inspection

can be very well worth while. The Dairy Panel would like the breed societies concerned to consider the question of bulls which go into A.I. centres from what we call the larger breed. How much importance ought to be paid to size and liveweight gain in bulls of that particular breed when trying to assess their merits for use in A.I. centres? The Panel would rather like a lead from the breed societies on this because we have heard from Professor Cooper what part the dairy cow has to play in the production of British beef.

MR PRICE: (*Monmouthshire*). Mr. Lofthouse earlier suggested that the control of A.I. should pass out of the hands of the Board into a Committee of breeders. I cannot agree with this and I do feel that we must give the Board a vast amount of credit for what they have done for the improvement of commercial cattle in this country. Dairy cattle improvement has, perhaps, reached a more advanced stage than with beef cattle but on the other hand the position in the dairy industry is equally critical at the present time.

CHAIRMAN: I am sorry but I must bring the meeting to a close and would like to convey to all members of the Panel and, in particular, to Professor Hendrie, our deep appreciation of the excellent job of work they have done on our behalf.

Report of the Sheep Panel

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PART I

THE SHEEP INDUSTRY—WORLD SITUATION

THE total world population of all classes of sheep was estimated at 916 million in 1959–60. Compared with the immediate pre-war situation this represents an increase of 142 million, or 18 per cent. A large proportion, approximately 35 per cent, is to be found in the Commonwealth, and only 9 per cent in Western Europe.

MEAT

In 1959–60 the sheep population of Western Europe, including Yugoslavia, was estimated at 79 million of which the United Kingdom accounted for 28 million, or just over a third. No figures are available for the world's output of mutton and lamb, but it might amount to around 6,000,000 tons per annum, of which only 7 per cent enters international trade channels. Exports from New Zealand account for approximately three-quarters of the world's total exports, while approximately 80 per cent of the world's exports are placed on the United Kingdom market.

The demand for and the prices of lamb and mutton in the United Kingdom depend upon four major factors, viz. (i) level of consumer incomes, (ii) volume of home supplies, (iii) volume of imports, (iv) trends in the supplies and prices of substitutes—namely beef, pork and, more recently, broiler chicken.

The pressure of imported supplies on the market is in the long run likely to grow rather than diminish.

WOOL

In the United Kingdom, meat is the prime interest of the sheep farmer; in Australia wool prices dominate management policy and in New Zealand output is divided fairly evenly between wool and meat.

World wool production (greasy basis) is at present about 2 million tons, an increase of 46 per cent since 1945. On the demand side there have been two conflicting influences at work. On the one hand, the demand for more and better quality clothing has increased as living standards (particularly in the Western World) have improved. On the other hand, there have been many new technical discoveries in the field of man made fibres, the production of which has risen rapidly.

PROFITABILITY OF SHEEP FARMING IN THE UNITED KINGDOM

It is doubtful whether margin (or profit) per ewe is by itself a satisfactory criterion for judging profitability. *The appropriate economic criteria are profit per acre of land, per £1 capital investment and per £1 of labour. These criteria are the product of a multiple function of which such considerations as lambing percentage, stocking rate, rate of liveweight gain, etc., are only single elements and it must of course be quite clear that the optimum solution to the problem of profit per acre of land, for example, would not necessarily imply that all or any of the technical criteria would be set at their maximum.*

Fat lamb production is likely to be more profitable than the production of store lambs, and lowland sheep are more profitable than hill sheep. The trend in costs continues upwards and, with decreasing profit margins, the supply of more efficient breeding stock is of increasing concern to all sheep farmers.

CLASSIFICATION OF SHEEP BREEDS IN THIS COUNTRY

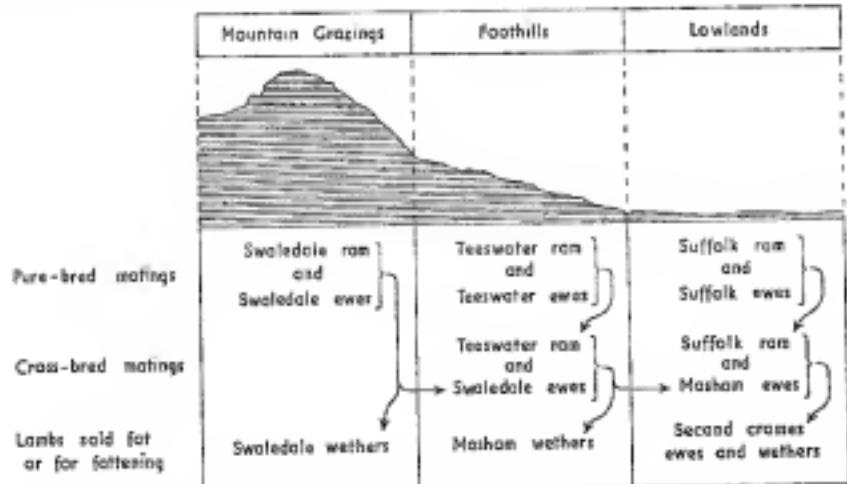
a. THE ROLE OF CROSSBRED SHEEP IN THIS COUNTRY

The main purpose of sheep husbandry in this country is the production of fat lamb, most of which is produced on lowland farms and the lowland crossing flock may be regarded as the central point in our sheep breeding.

The secondary purpose of sheep husbandry is the production of wool, a substantial proportion of which is produced on hill farms. In hill flocks the incomes from these two items are generally about equal. In lowland fat lamb producing flocks, the income from fat lamb sales is about five to six times the wool cheque.

The production of fat lamb and wool in Britain is maintained by an integrated sheep breeding system which has been developed over the past 200 years.

The general pattern involves the annual drafting from the mountains and uplands to the lowlands of commercial ewes of pure and cross-bred type for further crossing with Down rams. This system of *stratification* can be illustrated by the following diagram.*



* Reproduced from M.A.F.F. Bulletin No. 166. Sheep Breeding and Management.

The crossbred ewe forms an important part of the sheep industry in this country. Out of 28 million sheep shown in the 1960 census returns, over 11 million were breeding ewes. This breeding ewe population can be subdivided approximately, as follows:

1. $4\frac{1}{2}$ million hill ewes (i.e., ewes qualifying for hill subsidy).
2. $4\frac{1}{2}$ million crossbred ewes producing fat lambs and further crossbred ewes.

3. $\frac{3}{4}$ million draft hill ewes producing crossbred ewes.
4. $\frac{1}{4}$ million pure bred ewes which are not registered in flock books.
5. $\frac{1}{2}$ million registered pure bred ewes of the fifteen breeds which register ewes. About one-third of these ewes are involved in producing rams for crossing.

There are two substantial genetic advantages to a crossbreeding system such as is involved in stratification. Firstly, heterosis, which is the superior performance of crossbreds over the average performance of the parental breeds. Such an effect is likely to be greatest for characters of low heritability, such as fertility and milk yield. Secondly, growth rate and some aspects of carcass conformation may have a higher heritability and show a greater response to selection. They are most easily improved when attention is concentrated on them alone. This may be accomplished by having separate specialized ram breeds for this purpose, with some assurance that the qualities of the sire will be passed on to the second cross offspring.

The alternatives to stratification are two. The first is a pure breeding system with each breed being adapted to the conditions under which it exists and producing fat lambs as well as it can.

The second alternative is a crossbreeding system with steps similar to those of the present stratification system but not necessarily using breeds in sequence from the uplands and from the lowlands. Thus, if appropriate breeds were available such a system could operate entirely, say, on the lowlands. This would not, of course, make full use of hill resources.

We feel that stratification is the best way of making use of our natural resources and achieves a balance of animal and grass production on a national scale, unequalled elsewhere in Europe.

One factor which could, however, affect the system of stratification would be any reduction in the price of lamb over the next few years. These tighter margins could be critical for the hill farmer and might result in a greater area of hill land being devoted to other purposes, e.g., afforestation, thus affecting the supply of primary breeds in the stratification.

b. FUNCTIONS OF PURE BREEDS

There are about forty recognized pure breeds of sheep in Britain at present, which can be grouped into six basic categories, four of which are directly or indirectly involved in the stratification system. We have attempted to classify each breed into one of these basic categories in a manner similar to that given in the Morris Committee's Report on Sheep Recording and Progeny Testing (1961). Although breeds may fit into more than one category, they have been classified according to their main function.

In relation to these listed characteristics, other general considerations must be taken into account. Among these are the efficiency of food conversion, the optimum levels of prolificacy, suitability for intensive stocking and general health levels in different environments. In regard to food conversion, sheep farmers have taken little notice of breed and strain differences.

Because sheep are, on the whole, grazed extensively it is usually assumed that efficiency of food conversion is not important. We believe, however, that it must be of primary importance, particularly on lowland farms where land devoted to sheep might be used more profitably for some other enterprise. We stress the urgent need for more information on this matter.

Category	Important Characteristics	Breeds
a. Hill Flocks	1. Hardiness 2. Ability to rear 100 per cent lamb crop 3. Satisfactory quality and weight of fleece	Blackface Black Welsh Cheviot Dales-bred Dartmoor Derbyshire Gritstone Exmoor Horn Herdwick Hill Radnor Lleyn North Country Cheviot Rough Fell Shetland Swaledale Welsh Mountain Whiteface Dartmoor
b. Flocks producing the sires of crossbred ewes	1. Prolificacy 2. Milking capacity 3. Growth rate	Blue Faced Leicester Border Leicester Coloured Teeswater Wensleydale
c. Flocks producing fat lamb sires	1. Growth rate 2. Carcass quality	Dorset Down Hampshire Down Oxford Down Ryeland Shropshire Southdown Suffolk Wiltshire Horn
d. Lowland flocks producing mutton sires	1. Carcass quality 2. Growth rate	Cotswold Lincoln Longwool Leicester
e. Self contained flocks producing their own replacements, females for sale and fat lambs	1. Prolificacy 2. Milking capacity 3. Growth rate 4. Carcass quality 5. Weight and quality of wool*	Beulah Speckled Face Clun Forest Devon Close Wool Devon Long Wool Kent or Romney Marsh Kerry Hill Llanwenog North Country Cheviot South Devon
f. Lowland flocks being developed for lambing out of season and more frequently than once a year	1. Above average lambing frequency 2. Reasonable prolificacy 3. Milking Capacity	Dorset Horn Polled Dorset Horn

* Added to those characteristics listed in the Morris Report on Sheep Recording and Progeny Testing.

The cost of maintaining a ewe is a major one and the relation between her size, prolificacy and food conversion requires further urgent investigation. The ideal might be small ewes with a lot of lambs—is this a practical aim? Longevity is of immense importance in keeping depreciation on a ewe flock to a low level. Breed comparisons would be interesting and valuable.

c. SUITABILITY OF BREEDS FOR THEIR DESIGNATED FUNCTIONS

One of the most important questions for any sheep farmer is which breed to keep. His decision would be easier, and more likely to lead to success, if adequate factual information were available. Urgently required is an accurate specification of the performance of all our breeds of sheep under given circumstances. We feel that this work should be undertaken.

It is often said that each breed of sheep is only suited to its own district. We are doubtful whether this is necessarily true and feel that adequate and disinterested information about the relative performance of different breeds might increase the demand for more efficient sheep.

BREED SOCIETIES

Breed Societies appear to have three main objectives:

- i. To maintain the identity of their respective breeds and to foster competition with their own and with other breeds.
- ii. To increase membership and registration and by advertising to increase the demand for their products.
- iii. To list the attributes of their respective breeds and to promote sales.

We believe that Breed Societies should regard their function as a dynamic one. The funds available to many Societies are limited and quite inadequate for an extension of development work. We believe that the onus is on Breed Societies to demonstrate to their members that future development and improvement must be guided by progressive and far-sighted objectives.

Most Breed Societies are members of the National Sheep Breeder's Association whose organization represents also the interests of commercial sheep farmers.

This marriage of interests of commercial farmers with pedigree breeders is extremely valuable. It is necessary to make a close study of markets, to forecast and prepare for future demand, and to exert pressure to produce an article of high quality designed to meet progressive commercial requirements. At present this type of service is not being provided by Societies and we feel that this failure is a serious limitation on their value.

Maintaining distinction between breeds has been a valuable contribution of Breed Societies. The number and variety of British breeds is a source of strength to the whole sheep industry. The gene reservoir for future improvement is unequalled elsewhere in the world.

BREED STRUCTURE

Flock sizes vary from hill flocks of many thousands down to lowland flocks which have only two or three ewes. Hill flocks have an average size of nearly 180 ewes, while 3 per cent of them had over 1,000 ewes. At the other end of the scale those breeds which produce sires of crossbred ewes had an average of about twenty-five ewes each. The other two Categories, of ram producing

breeds and fat lamb and mutton sires, had average flock sizes of around fifty ewes each while the self contained breeds averaged about 150 ewes per flock. All categories had a high proportion of small flocks. Even among hill flocks two-fifths had less than fifty ewes and in the breeds producing sires of crossbred ewes over half the flocks had less than eighteen ewes. Such small flocks have little scope for adequate comparisons of ram progeny groups.

Information on the number of rams in use with each flock was not generally available for the hill breeds. For the remaining breeds the average number was between two and three per flock. About one-third of all flocks used only one ram and almost as many only used two rams a year. Thus, the majority of breeders could not discriminate effectively against an unsuccessful sire by disposing of his progeny. To select a son of a successful ram for further breeding would soon lead to a high level of inbreeding. Only in the 10 per cent of flocks having five rams or more is there much chance of an effective choice between rams or any value in selecting sons of the best for further breeding within the flock.

Little use is made at the present time of production records in the choice of stock for pedigree breeding. Most pedigree breeders are eager to sell, as quickly as possible, sons by rams for which they have paid high prices, in the hope of getting good prices in return.

A considerable number of studies of breed structure has been made in recent years and in each case a hierarchical structure of breeders has been shown to exist.

The essential characteristics of this hierarchy is that there are three levels of breeders. The divisions between levels are arbitrary and breeders are always moving from one level to another. The top level of breeders may be defined as those who provide the majority (at least 75 per cent) of sires of registered rams and who supply each other with the majority of the rams they require. The second level of breeders supply the remainder of sires but rarely do these rams go to the top level of breeders. The third level of breeders provide rams for commercial flocks or for crossing, but none of them are used for breeding registered pedigree stock. The top section include on average the largest and oldest flocks using the largest proportion of homebred rams.

It follows from this that any attempt at breed improvement will be profoundly influenced by the actions of the handful of breeders in the top level. Only genetic changes made in these top flocks will percolate down through the whole breed. Conversely, any breeder at the lowest level of the hierarchy can have little influence on the breed as a whole but we feel that it is quite feasible for a breeder well down the hierarchy to become more influential through breeding stock showing a high level of performance.

THE POSSIBLE EFFECTS OF NEW TECHNIQUES, RESEARCH AND METHODS ON REQUIREMENTS FROM BREEDERS

There is without doubt a great potential demand for improved types of sheep which could be a response to a specification from the commercial sheep farmer, but are more likely to result from enlightened breeders anticipating those requirements.

The tendency is towards bigger units which are complete departments in their own right and the keeping of sheep will become more intensive, whether

judged by the criterion of sheep per man, or sheep per acre. Furthermore, the large and intensive flocks of the future will be geared towards the production of a level supply of an article of consistently high quality.

The form that increased intensity might take varies from heavy stocking of heavily fertilized pastures, to indoor feeding based on more concentrated feeds. Differences between breeds, or between strains within breeds, could clearly render one more suitable than another for any of these purposes. Our present lack of knowledge of the kind of sheep required for any intensive systems of husbandry is primarily due to lack of research experience of such systems, maintained under controlled conditions, *for adequate periods of time*.

Although we have many different breeds and crosses, we do not consider this to be necessarily detrimental to the production of standard types of carcass. The trend in food retailing is towards greater emphasis on standard graded articles which can be ordered in large numbers.

It is not yet possible to give the specification of the required grades, but there is sure to be an increasing emphasis on the maximum lean meat content.

An increasing proportion of meat sold to the housewife will be in the form of prepacked joints. It may be that this trade will require fairly small carcasses (40 lb dcw) which can be broken down into reasonably priced joints.

The other main outlet may be to the catering trade, where a heavier carcass (50 lb dcw) is preferred.

For these two markets at least two types of carcass will be required from the breeder. They must both have the maximum muscle to bone ratio without an excess of fat, but they must reach this condition at different weights. We feel that the urgent need is for more clearly defined specifications.

Perhaps, the ultimate in fat lamb production might be considered as the year-round supply of lambs under contracts specifying numbers, weight and grades.

This is possible on both extensive and intensive systems, but if done intensively it is difficult to visualize its being achieved other than by an early weaning system, with lambs fattened away from their dams.

Hormone injection methods might be used on the ewes in the short term, to ensure a continuous supply of lambs. Work might be started in selecting and breeding suitable strains of sheep able to conceive throughout the year and with other desirable qualities. As such a production technique appears to meet an economic need its early development and trial seems desirable.

It seems likely that the time is drawing near when complete chemical control of intestinal parasites will be possible. This offers tremendous possibilities for early weaning, dense stocking and large specialist concentrations of sheep.

The future will see more capital being invested to save labour in sheep enterprises but it may be asked whether the sheep themselves might not be selected with ease of shepherding in mind.

Probably the most important characteristics of easier shepherding are, in order of importance:

- a. ease of lambing and good mothering qualities
- b. resistance to certain diseases
- c. suitable temperament.

It is possible that temperament may prove to be of vital importance to the success of very intensive systems and limit the range of suitable breeds and strains.

Recent developments in technique for wintering sheep indoors seem likely to result in an extension of this practice.

Under lowland conditions winter housing is increasingly being considered when annual stocking rates rise to such a level that poaching and sward damage become unreasonably heavy during the winter months. An increasing number of intensive specialist sheep enterprises will accelerate this trend.

Under hill conditions there is frequently an enormous difference between herbage growth in a short summer season and the almost total lack of feed during a long winter. In these conditions housing of breeding stock could greatly improve the total stocking capacity and we expect more farms to experiment on these lines.

The ability to finish store lambs indoors before the building is occupied by breeding ewes spreads costs.

SUMMARY OF PART I

- a. Increasing supplies are likely to result in falling prices for all sheep products. In the short-term, meat will probably fall more quickly than wool; breeding stock will follow suit.
- b. Sheep farmers will become more critical of the performance of their animals.
- c. There is a clear necessity for factual information about the performance of different kinds of sheep.
- d. We believe that stratification, as practised, will continue.
- e. It is apparent that many breeds as now organized are unlikely to change performance characteristics to any marked extent.
- f. In our opinion many Breed Societies have unsuitable objectives and organizations for modern requirements.
- g. We believe that there is likely to be an extension of intensive methods of sheep keeping.
- h. We foresee a greater demand for standard graded lamb with forward contracting and a lessening of differences in regional requirements.
- i. It seems likely that there will be a clearcut demand for both heavy and light-weight carcasses.
- j. We expect an increase in the development of out-of-season lambing.
- k. Economic pressures seem likely to lead to an extension of feed lots, or housing systems for breeding ewes and fattening lambs.

RESEARCH REQUIRED

Research is required on:

- a. The efficiency of food conversion in relation to lambing percentage, stocking rates, etc.
- b. Inter-breed and strain experiments on a wide basis to obtain accurate specification (including, if necessary, foreign breeds).
- c. Productive longevity, comparing different breeds and management systems.
- d. Characteristics of sheep to be grazed intensively.
- e. Intensive indoor systems for ewes and lambs.
- f. Control of reproduction, both chemical and otherwise.
- g. The influence of breed and strain upon lamb survival at birth.

- h. Development of practical methods for the improvement of weakly heritable characteristics by breeding on a farm scale.
- i. Management techniques in relation to flock size.
- j. The performance of crossbred sheep, e.g., how much of their prolificacy is simply inherited and how much is due to hybrid vigour, etc.
- k. Techniques of carcass appraisal.
- l. Fleece specifications.
- m. Should stock be bred in the environments where they are to be used?
- n. Techniques for performance and progeny testing.

PART 2

OBJECTIVES ATTAINABLE IN THE SHORT TERM

Objectives can be considered as attainable in the short or long term. To the sheep breeder, short-term might be defined as ten years and long-term in excess of that.

The short-term period could be expected to result in improvement through the identification and multiplication of those strains within breeds which possess the more valuable commercial characteristics.

The long-term prospect is an exciting one. Not only can existing breeds be made more efficient, but new breeds can be created, designed especially to meet future requirements.

We have re-examined the categories of sheep set out on page 79 and make recommendations which, in accordance with our original terms of reference, are concerned with "*increasing the productivity of the national flock*".

Hill Flocks

Hill conditions severely limit the performance of hill sheep. Selection for hardiness and prolificacy under these circumstances is bound to be a negative rather than a positive operation. Hardiness might be said to be the ability of a ewe to survive and produce and rear one lamb per year, during her breeding life under the particular hill environment. Under conditions where uniformity of environment cannot be ensured, it is difficult to establish a yardstick of hardiness. We recommend, however, that a number of flocks in each breed should give increased consideration to the question of milking capacity when selecting flock replacements.

The short-term objectives for hill sheep should be:

An average wool clip of 5 lb, with reduced variation in wool quality; ewe losses of less than 5 per cent and uniform growth of lambs through better milk yields. Under good management all these should be achieved in the context of 100 per cent lamb crop.

Flocks producing Sires of Crossbred Ewes

It is necessary, therefore, that those breeds which supply the sires of crossbred ewes should be highly developed for prolificacy and milking capacity. The targets we have in mind for sheep in this category are that the prolificacy of their crossbred daughters should be as near to 200 per cent as possible, that milking capacity on normal grass feeding should be sufficient for rapid growth in a lamb crop of this size and that the sheep themselves should have

demonstrably larger frames than the crossbred ewes which they are ultimately expected to sire.

Flocks Producing Fat Lamb Sires

It is difficult to differentiate between the merits of several different breeds as fat lamb sires. There is often more difference between strains than there is between breeds. As with sires of crossbred ewes objectives in these flocks should be ruthlessly simple. Growth rate comes first and carcass quality (primarily in the sense of conformation) an important second.

This category of sheep should concentrate on siring lambs to be killed at less than 42 lb deadweight.

Mutton Sires

The mutton sire requires very different qualities from the fat lamb sire; carcass quality is paramount and more important than growth rate. Breeds in this Category should concentrate on the ability to sire an acceptable 50 lb deadweight carcass out of a wide variety of ewes.

Self-contained Flocks Producing their Own Female Replacements and Fat Lambs for Sale

Self-contained breeds of sheep have a place in many different farming systems. Their development has led inevitably to a compromise between desirable qualities. In breeds where wool is of primary interest, we suggest, as a flock average, at least 10 lb. This should be accompanied by 120-130 per cent lambs able to fatten off their mothers. This type of flock should be developed under conditions of really high stocking density. For breeds interested primarily in fat lamb production, we suggest a target of 160-170 per cent lambs, with milking capacity sufficient to produce 40 lb deadweight twin lambs at 12-16 weeks. This might be achieved without sacrificing a wool clip of 6-7 lb. Flocks of this kind should be developed under a wide range of environments.

Flocks Lambing Out of Season and More Frequently than Once a Year

Little can be done to develop flocks for twice yearly lambing during the short-term; the most than can be expected here is the identification of suitable strains which may occur in breeds other than the ones listed on page 79, and which may be worth developing. It seems likely also that chemical methods for controlling frequency of breeding may become more prominent.

OBJECTIVES ATTAINABLE IN THE LONG TERM

In the long term sheep breeders will have to meet an increasing demand for animals that will perform uniformly and predictably, under expert management in specified circumstances. Breeders thinking ten years ahead must plan to meet the requirements of buyers far more critical than at present. Buyers will insist on:

- a. high performance for specified conditions.
- b. uniformity of performance in large groups of sheep.
- c. a continuing and adequate supply of suitable animals.

Several specific requirements must be catered for by breeders, during the next ten years or so as follows:

Hill Sheep

Much hill land will continue to be farmed extensively using traditional systems. Increased output of wool and lamb from those strains best suited to adverse conditions should already be apparent. The likelihood that hill shepherds will become increasingly scarce makes it inevitable that large areas of difficult country will have to support sheep capable of performing well with the minimum of attention.

We foresee a clear division of objectives in hill sheep; many flocks will continue on traditional lines, others will intensify their output by modifications in land and grazing management. In addition, there will be an increasing tendency towards intensification, with hill flocks housed for the winter and lambing indoors. This kind of system will require high lambing percentages and ewes will be returned to the hill with whatever numbers of lambs they and the hill can successfully manage for summer grazing. The rest will be reared artificially. Hardiness and the ability to forage during the summer will remain vitally important.

This division of functions could possibly best be done by developing some breeds for intensive systems and some for extensive.

On the national basis, a programme of selecting hill sheep for prolificacy would influence the productivity of a large proportion of lowland fat lamb producing flocks, and thus doubly benefit the industry.

Sires of Crossbred Ewes

In the next ten years we should like to see development of especially designed breeds which, when mated with hill breeds, would produce daughters of outstanding performance. High prolificacy is essential and the crossbred daughters must milk well enough to rear a considerable proportion of triplets without shepherding difficulties. Increased length of lactation is also important.

Under commercial conditions, crossbred ewe flocks may increasingly be kept where high output per ewe is of primary importance but where very high stocking rates are not necessarily required. Lambing percentages of 200-300 should not be unrealistic and adequate lamb growth at this level perfectly attainable.

Self-contained Flocks

Self-contained fat lamb producing flocks will increasingly be kept on those farms where high output per acre is the aim, perhaps at the expense of high output per ewe. Whether wool or lamb is their main product *it is necessary that breeders should set themselves targets which can be achieved within systems similar to the commercial conditions in which their sheep will ultimately be kept.*

Frequent and Out-of-season Lambing

Most important is the development of sheep that are capable of lambing more frequently than once a year. Although many individual sheep have shown this characteristic it has not been fixed in any flock or large group of animals. The trend towards intensive systems of sheep keeping will undoubtedly create a demand for sheep of this type. Breeders should think in terms of three or four lambs per ewe per year, from a ewe which needs to produce little milk and which will herself respond to early weaning and preparation for a second lamb crop. There are immense possibilities for this through

housing and early weaning and initiation of work of this kind is a matter of some urgency for the industry.

FUTURE PROSPECTS

It may be that sheep, as converters of vegetable matter into animal protein, will be required to play an increasing part in feeding large sections of world population now short of animal protein. Consideration should be given to the possibility of developing sheep able to live on unorthodox feeding stuffs; for example, seaweed. Research institutions should initiate long term experiments of this kind.

An increasing trend towards high productivity may well hasten the development of new breeds of sheep capable of bearing large litters of lambs which, in combination with some or any of the characteristics that have already been discussed, may well be essential in the years that lie ahead.

PART 3

METHODS OF IMPROVEMENT

During the last century British breeders were remarkably successful in producing sheep of world wide importance. Since this period, most breeds have succeeded in altering type to a certain extent but the degree of improvement in performance is uncertain. In general, breeding stock has been chosen by appearance leading to improvement in conformation, but less progress in invisible characteristics. An increasing demand for more efficient sheep will require that objectives to be kept in mind by breeders should be as clear and simple as possible and relate to the improvement of productivity.

BREED SOCIETIES

Obvious limitations make it unlikely that individual sheep breeders will easily acquire the large number of animals that are needed in a breeding programme. A breed is more likely to make progress as a result of collective efforts and an effective co-ordinating body is essential. Re-organized Breed Societies could be effective; they should establish authoritative committees to consider development. Their terms of reference would be to define clearly objectives within the breed and to decide its place in the overall stratification pattern.

The urgent need is for Societies to identify those flocks whose performance conforms most nearly to their clearly defined objectives. These flocks should be labelled as *Nucleus* flocks.

The way in which it could be done requires more discussion than can be given here. *It is essential to avoid false conclusions based on a comparison between shepherds and environments.*

Nucleus flocks would be described as such in advertisements, sale catalogues, show classes, etc., and description of size of flock, performance, stocking rate, etc., and any other information relevant to buyers would be issued annually. They would be subject to an annual examination when their status would be confirmed. At this time other flocks could apply for recognition. Thus, there would be a steady movement of important flocks into the nucleus category, with unsuitable ones discarded annually.

Other ram-selling flocks within breeds might be classified as *multipliers* and again labelled as such. These flocks would have the opportunity for regrading annually on the basis of flock performance judged on the declared objectives of the breed.

A third classification of flocks within most breeds should be *experimental* flocks. The objectives would be as for the others, but it would be clearly recognized that sheep of other breeds might be introduced in an attempt to increase progress in the desired direction. These flocks could, if necessary, be entered in a separate section of the flock book or register. An annual review of progress could decide when they should be re-graded. Success might turn the register into the flock book.

Technical advice and the provision of some central register should be within the reach of the larger Societies. The smaller ones might usefully provide such a service in collaboration with other Societies or by arrangement with the N.A.A.S.

Those breeds whose main function is to combine with other breeds should consider much closer collaboration than is now common. Crossing breeds should develop themselves for use with another specified breed.

We would like to see co-operative breeding schemes organized by Breed Societies for their own members to overcome the problems of selecting rams for small flocks and the likely scarcity of central testing facilities. Groups of breeders would be able to arrange for progeny testing and the exchange of rams amongst themselves. By using joint recording schemes they may also be able to reduce the overhead costs of recording. All Breed Societies should reconsider their flock competitions and judging standards; recognition should be given to those animals or groups of animals that seem likely to contribute to breed progress.

Show Standards

We do not advocate the abolition of showing. A suitable skeletal structure, conformation and thriftiness are valuable assets which can be displayed by individual animals. Uniformity within a breed is also useful and will become increasingly valuable as each breed becomes more prepotent for economically desirable characteristics. We also value shows for the way in which contacts are made between people with a common interest in the breed and for the opportunities they provide for gathering together stock from different breeders.

Imagination could be used in re-thinking the standards by which animals are judged at agricultural shows. Efforts should be made to give credit to valuable characteristics; for example, where conformation is important the animals should be shown shorn bare, with possibly a lock of wool left on the breech or shoulder to show the quality of the fleece. We suggest an extension of showing groups of animals as opposed to individuals and shows should be arranged in such a way that sheep have the opportunity of demonstrating the attributes for which they are bred.

Breeding Systems

Genetics has made it evident that anyone who is willing to take the pains to analyse his animals can (use with varying degrees of success to be sure) the only tools which ever have been or ever will be available for animal improvement—breeding systems and selection.

Use of Records

If any improvement is to take place in a flock, some recording will have to be undertaken, at least of those characteristics relevant to the breeder's objectives. Ewe recording is a basic requirement in any flock in which performance is to be improved. The records may be used for:

- a. culling individual ewes with poor performance records, and
- b. bringing to light possible faults in management policies.

In more complicated systems, performance of families will be valuable in comparing the merits of rams.

Problems in Compiling Records

The most general problem will be that of identification. Weighing facilities may involve providing a weighing machine, or contracting to have sheep weighed by a portable machine. Methods will have to be found of determining the sire of each lamb born. Owners of small flocks using only one or two rams each season cannot keep a ram for further breeding, since this would lead to a high level of inbreeding. They are thus forced to take rams from other flocks and are dependent on access to other breeders' records.

Supervision of Recording

Some sort of central records organizations will be required; some Breed Societies might organize their own schemes. The objects could be:

- a. to encourage recording, provide record forms and assist with provision of ear tags, weighing machines, etc.
- b. to visit flocks and advise on techniques of recording.
- c. to assist in analysing records where required.

Recording Societies may be formed on a regional or breed basis but some uniformity of records is desirable if comparisons are to be made easily. There are advantages in uniform recording systems, though there will obviously be some variation due to the different objectives of different classes of sheep.

Advice on Use of Records

Advice may be required on the problems of relating breeding objectives to the records a breeder keeps. The recording societies may be able to supply such specialist advice or it may be obtained from the National Agricultural Advisory Service. We feel that the Livestock Husbandry Officers of the N.A.A.S should be in a position to advise on breeding problems. Furthermore, they should actively foster constructive breeding programmes.

New Breeds

Certain objectives may be achieved more easily by deliberately creating new breeds of sheep than by attempting the improvement of existing ones.

There are two ways of tackling this problem. The first is to produce animals which may not be spectacular performers in their own right but which, when crossed with other suitably bred lines, produce high performance hybrids.

The second approach is to create new pure breeds which themselves are better performers than other comparable sheep. Ample resources are essential, as are patience and really clear objectives. In addition, such projects must be conducted on a sufficiently large scale to allow adequate numbers from which to select.

We have no strong feelings about who might undertake this kind of work. Private individuals as well as suitable institutions have a part to play.

Cyclical Breeding

We wonder whether purity of breed in the conventional sense is sometimes taken to a point where it is no longer useful. Under hill farming conditions, for example, we believe that improvement in hardiness and fleece weight could probably best be achieved by a cyclical crossbreeding programme.

Artificial Insemination

There seems little likelihood at present of the artificial insemination of sheep being used on a farm scale in this country but for performance and progeny testing the advantages are apparent. For example, development of cross bred ewe sires could proceed more rapidly if extensive comparative trials could be arranged with the help of A.I., although at the moment, management difficulties make A.I. a troublesome process.

Ova Transplantation

There is little to say about ova transplantation but it is a process of possible value to certain breeders in that extremely fertile ewes could be used for rapid multiplication of less fertile strains.

Discussion on the Report of the Sheep Panel

MR. W. J. CLARKE: (*Hampshire*). We are all pleased to learn that the Panel is coming out in favour of what we have been trying to do for years in the Down breeds, that is, to get early maturity and suitable conformation. We have done this in a rough and ready way by picking out the earliest maturing rams but now I think most people do record the weights of their animals. We do find it difficult to get the exact conformation and many of us think that the Royal Agricultural Society could do more to help us in this way by means of carcass competitions.

MR. W. J. HOOPER: The breeding societies will welcome this very carefully thought out report and I hope we shall hear a lot more from them about this. The Panel amply put the case for a development authority, such as the National Sheep Breeders Association has been working on for the last two or three years.

COLONEL D. KENNEDY: There is not, in my view, a lot wrong with our British pedigree production at the present time and the refreshing part of this sheep report to my mind is the fact that the Panel proposes to keep what our forebears have built up over a hundred or more years since livestock production was first improved in this country.

A speaker from the floor asked whether the Panel had thought of measuring or recording the performance of mothers of lambs. This is an important point and a lot of breeders have concentrated on conformation and forgotten about milk production and the lamb's rate of growth.

MR. COLBURN: We have not put forward any definite schemes for anything, but I am in full sympathy with what you say, namely, that any characteristic should be improved within any breed when the breeders have decided what they want. Referring to what Colonel Kennedy said, we have nowhere in our report suggested that the British breeds of sheep are inadequate. What we were trying to do was to look at the economic and technical situation that we think will obtain in the next ten or twenty years and then to suggest what characteristics in our sheep are required to meet those conditions.

DR. K. C. SELLERS: (*Essex*). As a veterinary surgeon I was rather startled by the omission of animal health under Mr. Colburn's heading of "Research Required". The new methods of sheep breeding, rearing and so on will raise health problems and these should be dealt with early in the day rather than wait until they occur.

MR. COLBURN: We left health out of our list of research projects because we specifically intended to refer to breeding; there is plenty to do there but obviously I am in complete sympathy with the need for research on animal health.

MR. ADAMS: (*Herefordshire*). In the report Mr. Colburn referred to the need for early weaning in connection with more frequent breeding and also the need to use specific breeds for intensive stocking. How much importance does he attach to these possibilities?

MR. COLBURN: I personally believe that both of these things are likely and the Panel were fairly unanimous about it.

MR. J. F. PERCIVAL: I was pleased to see that the Panel emphasize that the improvement in sheep will come mainly from the ram but I would like to ask them whether they would agree that the so-called improvements in our hill breeds are tending to lose hardiness. Also, with regard to the Masham do they consider that the black and white face is supremely important and whether the insistence on single tup lambs in ram breeding flocks is a good thing.

CHAIRMAN: I am going to ask Mr. Wannop, the director of the Hill Farming Research Organization, and a member of the Panel, to reply to that question.

MR. A. R. WANNOP: I really wish I knew the answer to this question about hardiness. A few years ago a colleague of mine did a survey and came to the conclusion that there had been no loss of hardiness compared with the beginning of this century. On the other hand, Dr. Alan Fraser would say that we are sheltering under an umbrella of vaccines and therefore we do not know. My own limited observation is that our sheep are grazing the hills just as much as ever they did and, if we cut out infectious diseases, are really just as good as my grandfather told me they were.

A speaker from Aberdeenshire said that the report might have given a little more encouragement to ram breeders because if the breeder is going to provide something better in future he should get his proper reward for it. There

was some reference to amalgamating breeds but there is a place for all our present breeds if they are where they can thrive properly.

MR. COLBURN: I agree that there is a place for all our present breeds; what I said was "amalgamating breed societies" so that breeds whose true function was to develop an association with one another should have some kind of joint organization.

MR. M. RICHARD: (*Newcastle*). It has been said several times in the report that it is up to the breeders of crossing lambs to demonstrate the superiority of these lambs to the people who are buying them; a breeder who is selling a ram for the production of crossbred daughters should be able to say something about the productivity of these daughters either in flocks of the same crosses or in relation to rival breeds.

Another questioner asked if Mr. Colburn would enlarge on the subject of cyclical crossing of hill sheep.

MR. COLBURN: Looking at the characteristics that in future may need improvement in hill breeds such things as fleece weight and quality and the ability to rear 100 per cent of their lambs, we feel that all these characteristics can be improved more quickly by some kind of crossing system that introduces hybrid vigour.

A further questioner referred to the point that the customer requires a standard product.

MR. COLBURN: A standard product from the lowlands in the shape of fat lambs is a very different matter from hill sheep producing draft ewes.

J. FARNDALE: (*Derbyshire*). The report on the one hand points out that there is an increase in sheep numbers without any correspondence increase in consumption and under these conditions the aim of the lamb producers must be to produce lambs cheaply, presumably mainly from grass and yet the Panel recommends intensive artificial production of lambs in houses and with mostly concentrate feeding. These points appear to be incompatible.

MR. COLBURN: Obviously we have got to produce cheaply but the Panel think that there is scope for doing this in two ways and I am sure that we must think about doing it intensively indoors with hand feeding. One of the things the Panel tried to point out was that if we are going to do that sort of thing we have not at the moment got suitable sheep. If we are thinking in terms of high cost housing and high cost feeding it could only be done on the basis of a ewe that has three or four lambs a year which are reared artificially; perhaps three or four is not enough, we might be thinking in terms of six or seven lambs a year or even of litters of lambs which are reared artificially.

A speaker from Dorset, referring to the fact that buyers want lambs from ewes that have had twin lambs all their lives, asked whether there is any evidence of the ewe passing on this characteristic. Can we say that the daughters are bound to be good because the mothers are or shall we have to say "come back in ten years time, we don't know yet".

MR. COLBURN: If you have got a buyer don't send him away for ten years. These characteristics are inherited only weakly so that it is not possible to take a good ewe and say that the offspring are going to perform better than

the average. The heritability of prolificacy is only about 10 per cent or 15 per cent so that you cannot say that a lamb from a ewe of that kind is necessarily going to produce more prolific daughters than another lamb. That is why it is so necessary to carry out progeny testing. What can be said is that in a flock where the breeder is progeny testing and recording there is a much greater likelihood of a buyer getting what he wants than if he goes to a flock where he can find a sheep which is apparently identical but which has no records behind it.

MR. J. MAULE: The report refers to the breeding of new types of sheep such as the Romanoff, and Mr. Colburn himself has introduced the East Friesian. The Animal Breeding Research Organization has other highly prolific sheep and I would like to make a plea for greater freedom for breeders to introduce new breeds. There is a certain amount of resistance on the part of the Ministry of Agriculture to the importation of new breeds.

MR. COLBURN: I would like to endorse that.

MR. L. J. LABOURNE: (*New Zealand*). I would like to refer briefly to two points that have been raised in the discussion. The first is the question of lambing more frequently than once a year. This is related to the length of the breeding season and in Australia, for example, it is possible to build up sheep flocks quickly after a drought by the simple expedient of lambing perhaps three times in two years, because the Australian Merino has a breeding season of eight to eleven months. The British breeds have mating seasons of only a few months and in order to increase the number of lamb crops, mating must take place either at the very beginning or very end of this limited season. Perhaps Australia might export sheep to this country! My second point refers to variability in a system of cyclical cross-breeding. This type of breeding need not necessarily produce great variations. The greatest variability usually occurs when you mate two cross-bred generations together. If you continue using a pure bred sire or if you continue using a first cross there is a surprising degree of uniformity in the progeny.

MR. R. FEATHERSTONE: (*Rutland*). One point that has not yet been raised and perhaps the greatest economic fact in reducing our costs would be to increase the length of life of the ewe. What is being done on the subject of dentition and diet? If we can keep our ewes on to ten years old we would cut our cost tremendously.

MR. COLBURN: There is quite a lot of work being done on both of these. In my summary I have not had time to mention the question of longevity but in the report we have said how important we think it is. There is no reason at all why the productive life of ewes should not be increased quite a lot. I doubt if at present it is much more than three lactations in a flock and there is no practical reasons why it should not be five or six, which would make an enormous difference to depreciation.

CHAIRMAN: I note that two or three of the breed society representatives have spoken but none has considered the question which Mr. Colburn asked about the type of organization which will be possible in the future. Perhaps this could be discussed among the breed societies and the result of their discussion come forward either through the National Sheep Breeders' Association or

perhaps direct to Mr. Colburn. I must now, on your behalf, endorse the many compliments which have already come from the hall and thank very warmly not only the Panel for their work in preparing the report but Mr. Colburn for presenting it in such a delightful manner this afternoon.

Summing Up and Proposals for Future Action

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SOME of you have perhaps been alarmed that this Conference should begin with a talk by a geneticist and should end with one—it looks a little like weighting the scales too much in one direction. As a consequence I thought it might be well for me to try to step back from the situation a little and see it as an individual rather than as a professional geneticist closely involved. I have a little qualification to do this as I am to some extent an individual of the kind frequently talked about at this Conference, but bimself talking very little, that is to say, a commercial farmer.

There are two elements of my education which are perhaps important today. For the last ten years, I have been closely concerned with the breeding policy for Friesians at the Cambridge A.I. Centre, where we have been carrying out the sort of breeding programme that the Milk Marketing Board have eventually come round to some five years later. This has done me a great deal of good. On the whole the breeding programme has gone satisfactorily, it can hardly be said to have revolutionized cattle breeding, but it has been a new approach in which the breeders and the scientists involved have got along happily together, perhaps because we were only doing things on a small scale. We have bought a lot of bulls in this period, some good, some average and some pretty poor. The opportunity to make mistakes is always educational. Sometimes, when I hear breeders criticizing the level of bulls in A.I., both dairy and beef, and suggesting that they could do the job much better, I feel that they ought to be allowed to try. They should be given the privilege of making mistakes, always provided that the evidence that they have made a mistake can be firmly rubbed on their nose. By the way, why is it always the man who buys the bull who gets the blame and not the man who breeds it?

Now the second education has been in having a quite a lot to do with the British Cattle Breeders' Club (mentioned yesterday) which was originally started jointly by George Odlum and Sir John Hammond to be a place of discussion between scientists and cattle breeders. You will remember that Wellington is supposed to have said on reviewing some reinforcements before Waterloo "I don't know whether they will frighten the French but by God they frighten me." I don't know whether we have succeeded in conveying very much to the breeders, but by God they have altered me. I reckon that it took me about ten years to discover what really made cattle breeders tick. Here I want to distinguish quite firmly between what they say they are trying to do and what, in fact, they are actually doing. One of the basic reasons for the difficulties between geneticists and breeders is that the two can be apparently using the same words and having the same objective, but never making any contact at all.

I see the phrase "proposals for future action" in the title of my talk—this came as a bit of a surprise to me, but I have carefully not enquired on high

exactly what this meant lest I should be told to propose. But, before I deal with the various proposals that have been made, let me discuss in a very general way the problems that underlie action in the field of animal improvement. Many speakers have laid emphasis on the fact that the final judgment in "improvement" has to be made in economic terms. You cannot get away from the fact that somebody at the end of the chain is dealing in pounds, shillings and pence. But economics come into the actual breeding improvement operation itself, apart from the cost of basic research. Selection is choice based on adequate information. This information, whether it concerns the buyer of breeding stock or the breeder himself, cannot be got without spending money and some of the costs of getting the necessary information are extremely high. Mr. Thornber, for instance, quoted a cost of £150,000 every year to get the information on which to base his breeding decisions, but his decisions in trying to improve the economic merit of his stock are pointless unless he knows that there are some customers looking for stock with precisely this aim of profit per bird in mind, and the presentation of adequate information to these people in accurate comparisons between the commercial poultry available again costs money in setting up random sample testing stations. In the pig industry we have the chain of progeny testing stations and now some performance testing stations as well. In the dairy industry, the cost of milk recording runs into several hundred thousands of pounds. Some of this, of course, falls upon the individual breeder who must record and who must run his management in a slightly more expensive way than if he were merely a commercial producer. The same things apply to the beef and sheep industries. It always costs money to run a breeding programme and any extension of sheep recording and of beef recording means that somebody has to pay.

Consider for a moment just how changes in our breeds of livestock come about. I think the prime causes are the decisions of the buyer of the stock (whether day-old chicks or Down breed rams or bulls for artificial insemination) as to just what kind of stock he wants. For Mr. Thornber to spend a lot of money on geneticists, he must know that there will be people wanting to buy the sort of stock that the geneticist is trying to produce. So the first need in the real improvement of our livestock is commercial farmers (or people representing them) who will pay a little extra for this sort of stock and who have the information on which to buy it. So the first choice in the chain of selection is made by the commercial user of the stock. The buyer decides what he means by "improved stock" and in the last resort the buyer gets what he deserves. That some of our breeds of livestock have apparently not changed very much over the past thirty years probably means that the commercial users of these breeds are quite happy with what they've got and can't imagine having anything better. And, by and large, the breeder provides the sort of stock that the buyer wants, if he doesn't do this he very soon goes out of business. Of course he can always use his undoubted prestige in the farming world to tell the buyer that the sort of stock that is being sold is what the buyer should really want.

Let me sum up what I am trying to say here. There is no point in just telling the breeder what he should be doing and hoping for the best. You have to convince him, first of all, that somebody is going to buy what you want him to produce. He is an economic animal too and this may be why some parts of livestock breeding may be immune to breeding developments as in the broiler industry. There will be just not enough profit in it to justify the effort.

Let me wander off the point to stress the time factor. Breeds can be altered from within only very slowly, but the buyer can change his mind very quickly and so we come up against the situation in which the breed is effectively dead before anybody realizes that it is ill. The buyer has decided to go somewhere else and there just isn't the enthusiasm or the capital or the time left to bring the breed back to be a real competitor.

Because the breeder sees a different aspect of the economics, he may tend to judge his success by his ability to sell breeding stock and in this he is hardly to be blamed. He then judges his success by his income from the sale of stock which his commercial customers may have the greatest difficulty in judging in financial terms, and so we come to the situation which, I think is, to some extent, true in the beef breeds in which the final judgment of a bull tends to be the price that he makes in the auction ring. But from the point of view of real livestock improvement, this is not the end, it is only the end of the beginning of a bull's career. I think, furthermore, that the top breeders generally overestimate the economic merit of the stock that they sell; at least that is my general feeling after having bought bulls from fashionable breeders; that they tend to confuse their undoubted skill as managers (which is necessary for a breeding herd) with their skill as breeders. This is where a closer association between the top cattle breeders and the A.I. movement should be of great benefit to the breeders themselves in putting their focus right. Whatever are the other defects in the A.I., there is no doubt about it that a bull can be judged in A.I. much more clearly than he can be in any other way and the merit of his bulls in A.I. must be the critical judgment of the success of any breeder.

Now let us consider the geneticist's view of things. He tends to regard individual animals either just as symbols on a piece of paper or perhaps as units like the Drosophila or mice that he works with in the laboratory. He may then take a rather simplified view of what makes an improved animal, whereas the breeder, as Dr. Donald has suggested, may in fact take a much too complicated view, may dissipate his energies on attempting to improve unimportant things that would not deteriorate if he forgot all about them. The geneticist then writes some articles for the farming press or gives a few talks to breeders and is rather surprised and perhaps hurt when the breeders, who appear to be interested in the same sort of things as he is, either ignore him altogether or sneer at him. Then he tends to write them off as either fools or knaves, retires to his laboratory and there the matter may end in mutual distrust. Now this is unfortunate because there are in all breeds some exceptionally shrewd and intelligent breeders doing, with great ability, the job that they have set themselves. There is no doubt in my mind that, once granted that the aim of an Angus or Beef Shorthorn breeder is to sell bulls at the Perth sales for export overseas, there are individual breeders in each breed doing this very efficiently and I do not think that the geneticist has a great deal to contribute to these skilled breeders doing their extremely specialized job. What I am not sure of is the relevance of what they do to beef production in this country.

The help of the geneticist is mainly valuable in focussing attention on what is sensible and what is not. There is little in breeding method that has not been tried before, but just because our grandfathers did a thing, it is not necessarily now the best. But there is something that the scientist should be able to give to the situation over and above his specialized knowledge as a geneticist. From his training he should at least be skilled in the interpretation of evidence put before him, especially in terms of numbers. He should be able to assess

accurately just what certain bits of evidence mean and what exactly their implications are. More than that he should know fairly exactly what he knows and what he doesn't know (though this is a faculty remarkably undeveloped in some people, even reputable scientists). It is remarkable for instance when you read the Sheep Panel's Report how only recently it has become clear how little we know about many aspects of our existing sheep breeds and of the crosses between them.

To quote from a recently published book (which has already been mentioned at the Conference) "The British are still capable of surrendering to facts provided they are told them but our Institutions and the men who work them have, I believe, become dangerously out of touch with the public, insensitive to change, and wrapped up in their private rituals"—and that is why we are here today. But before the breeders assume that I am aiming at them, you will not need telling that geneticists and marketing boards and, above all, Ministries, have their rituals too.

Finally I will deal with one other general aspect of livestock improvement, the need for a flexibility of approach within breeds. Dr. Donald has commented on this; he said "In fact there is quite a lot to be said for the production of different and competing types within breeds." This becomes even more true as the numbers of breeds that we have decline. As I said earlier, the buyer can change his mind a good deal quicker than the breeder can change his breed, markets can change very quickly. As things are now what happens first with a change of economic emphasis is a change in the relative numbers of different breeds. A particular breed must not only meet the present market, but must also be prepared to meet the market in ten years' time. There is, therefore, an advantage in having a breed split up into several strains, some of them perhaps being very small, all aiming roughly in the same direction, but with rather a different emphasis in each case, and a further insurance value in having some quite stupid breeders who don't give a damn about the present situation and who are just going to follow their own whims. Our top beef breeders may be scornful of performance testing at the moment, but have they taken enough insurance against the overseas buyers coming to Scotland more and more with performance tests in their minds? This lack of flexibility is the fundamental danger of having the *breeding policy* in any breed in the hands of one organization. Denmark has gone furthest in this direction with the complete domination of dairy cattle improvement by the A.I. movement. This has in many ways been fruitful. Red Danish cattle have probably improved more in the last twenty years than have any other dairy breed, but this sort of extreme specialization, with all the cattle of the breed belonging to the same strain within the breed, must lead to a loss of flexibility in the face of economic change. This, of course, is one of the facts of evolution, that if a species becomes too specialized to one kind of environment it pretty soon ceases to exist when the environment changes. The reward for too exact present specialization is only too likely to be eventual extinction.

Turning now to the reports by the Panel chairmen, let me try to underline some of the main points that they have made. The present situations are obviously very different in the three types of animals. One general theme running through the reports is the importance of breeders co-operating to make larger breeding units than have previously existed. This will not be exactly new to Friesian breeders, where the Terling and Lavenham herds have been at the size of about 800 cows for many decades and we have seen

the formation of co-operative groups of dairy cattle breeders, such as the Cattle Breeders' Services. In a similar way the introduction of Polled Herefords into this country has, in many cases, been carried forward by co-operating groups. Further, it has always seemed to me that a very close co-operation (in terms of a detailed knowledge of the individual cattle in the most fashionable breeding herds) has always existed amongst top pedigree breeders, particularly the beef breeders. The top breeder has generally a fairly good view of the breed as a whole, or at least of the herds whose breeding operations are important to him. Nevertheless, it is important that we should in the future see much more co-operation in actual breeding operations and this will of course have to extend to cover commercial beef producers if progeny testing based on commercial crossbred animals is to spread at all.

The sheep Panel has given a very detailed analysis of the situation and detailed recommendations to meet it. It sees great husbandry changes in the very near future and has tried to put forward its recommendations accordingly. The main organizational emphasis is put on the breed societies themselves. The report has a most interesting section on the breed societies and the Panel is obviously not too happy about the present role that they are playing. Nevertheless it sees them as being at the centre of future improvement programmes. I think one might well ask whether the breed societies can find the necessary capital and technically trained people to do this. Without trying to pre-judge the issue of whether or not we have too many sheep breeds, cannot a good case be made for saying that we have too many sheep breed societies? In the dairy world there have been suggestions in the past month about a merger of the organizational side of the red breeds of dairy cattle. Should we not go the whole way with sheep and suggest that the National Sheep Breeders' Association should be the organizational focus of the technical side of sheep improvement. There remains much basic information to be collected about the performance of individual sheep breeds and the crosses between them under various types of management, not to mention the possible existence of strain differences within breeds. No doubt the gradual extension of sheep recording which has now been started on a pilot scale by the National Agricultural Advisory Service will gradually fill in the picture on this side and the information being collected by Animal Breeding Research Organization and Hill Farming Research Organization should be invaluable in providing background information. I would emphasize finally two points made in the report. The first is that the improvement of breeds supplying the sires of crossbred ewes would be one of the most rapid ways to improve productivity in the National flock. This is obviously very difficult for the animal improver especially when one sees that the flock sizes for the main breed of this type, the Border Leicester, are amongst the smallest of any breed in the country. I would have thought that the sheep industry had enough genetic variability already but it may be true that the best solution here is to make some new genetic combination as the Panel suggests. Finally I would draw attention to Dr. Donald's comment made again in the sheep report itself about the possibility of using hybrid vigour in our hill sheep flocks. This is an interesting suggestion which should not be too difficult to investigate or to put into practice if the results seem promising.

The beef cattle report stands midway between the sheep and dairy reports. We know more about the beef industry than about the sheep industry, but the Panel points out how meagre our information is about what sort of a

carcass is desirable and about how we can make useful judgments of carcass quality on live animals. The Pig Industry Development Authority work has been mentioned in this connection—it was spoken of with scorn yesterday, but is it not encouraging that such a large organization should have the guts to question its own activities? Obviously there is a great deal we need to know about beef carcasses too. Three points in the report struck me as being interesting. Performance testing has been practiced in a not very co-ordinated way in this country for several years now and recent developments concerning the R.A.S.E. showground will perhaps help as a focus. But I suspect that these tests, apart from indicating that we have perhaps unduly ignored some of our promising beef breeds, will not greatly affect pedigree breeding operations until the buyers from overseas come looking for such information. I find it very difficult to make up my mind what effect on breeding the considerable volume of performance testing being carried out in the United States is having. Has it really come to stay or is it merely a temporary fad? This is the sort of question that, prejudices apart, should be of vital importance to our beef breed societies and the sort of question that Professor Cooper's Beef Industry Fellowship could usefully answer. But I would recall to you the comments on performance testing during the discussion where it was suggested that we should bear in mind the different emphasis given to our different beef breeds and modify the conditions of testing accordingly. The second point concerns A.I. which has perhaps been unduly ignored by pedigree beef breeders as a tool in improvement. Could not the breed societies think again whether this blanket prohibition of A.I. is not really holding things back and whether some limited permission for its use in pedigree beef breeding might be considered?

But the most controversial suggestion is the setting up of a National Authority for beef cattle improvement. I am very glad that Professor Cooper was at pains in his presentation of the report to remove the impression that the word "authority" gives, and speak instead of a body doing development work for the beef industry as a whole. Is it too much to hope that the National Cattle Breeders' Association could have some technical teeth and perhaps have technical officers seconded to the new fellowship. Just as in the sheep industry it seems that the National Sheep Breeders' Association's role can be made more constructive it may also be possible that the National Cattle Breeders' Association can act in a similar way for cattle as a source of technical information to the breed societies. Is there something here that the livestock division of the National Agricultural Advisory Service could do? However, I think that we must welcome and support the suggestion of the Panel that some sort of development organization be set up.

I find it a little difficult to comment on the dairy cattle report having been a member of the Panel, but I would draw your attention to the fact that the main points it makes are comparatively trivial ones (if I may say so without offence to our chairman). I must say that, though I have not much enjoyed doing this present job, the dairy panel was great fun. We were polite to the chairman but, at one time or another, every one of us was told off by one of our colleagues for talking nonsense—I hope that none of us has been the same since. The common ground between scientist and breeder is already very large, national milk records have existed for some thirty years and we have well documented evidence on many aspects of dairy cattle production which it takes a very blind man to ignore. If I may quote from our chairman's

report "In all our deliberations I could detect no gulf between scientist and breeder beyond the perfectly honest exchange of views taken from legitimate but different standpoints." There is no doubt that A.I. must considerably alter the balance of powers within dairy cattle breeding. The number of bulls sold each year has declined by a factor of more than two and the prestige of the dairy cattle breeder is rather less in the farming world than it was before. On the whole the pedigree breeder has not really accepted A.I. as a tool for breed improvement or as the final challenge that he has to meet in showing that his stock really has commercial merit. He has not really made up his mind how to live with A.I. because he is far from certain whether A.I. means him to live. Having accepted that A.I. is here and will stay and has somewhat diminished the prestige and income of the breeder, I do not see why we cannot reach a satisfactory solution to this. If the private breeder did not exist, the A.I. movement would have to invent him.

It must be faced that some of our main difficulties in dairy cattle breeding are quite simply and straightforwardly a question of personalities. When I am in moods of depression I sometimes reflect that perhaps much of my next ten or even twenty years may be spent listening to a repetition of the bickerings of the last five. In some ways the breeders have my sympathy in all this, I think that they really feel that they are going to be overwhelmed by the power of the Milk Marketing Board A.I. organization and I am not surprised that they occasionally get alarmed. From my point of view the Milk Marketing Board has done an excellent job but I am afraid that Dr. Edwards missed a great opportunity yesterday. He rather complacently gave the impression that all cattle breeding wisdom had been deposited at Thames Ditton and that the breeders could lump it. Mr. Meiklejohn declined to lump it, but I think pressed his case for the breeders too far. However, irrespective of the strength of the case, the important point is that the breeders do feel very strongly about this. This longstanding quarrel has been unfortunate but there are signs that the financial aspect may be solved. Let us hope that this would be a beginning of friendly relations on all sides. Perhaps the most unhappy aspect of this is the way that the undercurrent of division between the two sides tends to enter into the discussion of almost every aspect of dairy cattle breeding and makes factual and unbiased discussion very difficult.

Finally let me quote two sentences from Mr. Meiklejohn's paper "Is it impossible to imagine a situation in which the Board passes on to the societies all the statistical information that it has and the societies help the Board to find the best bulls for A.I.? A situation in which the best breeders are only too anxious to have their most promising bulls tested for A.I. secure in the knowledge that if they are as good as expected the breeders will get a commensurate return, a situation in which the Board's geneticists could come to our meetings if we wanted advice and in which we would be represented when the choice of bulls was being considered by the Board." Well why not?

However, the Ministry organized this meeting. Where does it come into the whole operation? I would hope that we shall, in the future, see the Ministry playing a much greater positive role in livestock improvement than it has in the past. Is it impossible to imagine that the Ministry could develop into a real third partner with the technologist and the breeder in all this? After all it has its livestock officers whose time is becoming less and less occupied by the duties of bull and boar licensing. We have seen in Holland and Denmark state officials playing a leading role in livestock improvement. The

Ministry are at the moment helping a great deal with the start of sheep recording, they are responsible for the Charollais experiment and they will presumably also play a large part in beef recording.

Now we come to the end of the Conference and my job is to tell you that you have enjoyed it and should look back on it as one of the great events in your life. Perhaps we will in fact recall it as a critical occasion when some of the ideas that shaped our livestock industry for many years were first put forward and thoroughly discussed in public.

Vote of Thanks

W. P. DODGSON

*Chief Livestock Husbandry Officer
National Agriculture Advisory Service*

BREEDERS and geneticists will get together before very much longer—they will be running like mad to catch their trains.

The organizers of this Conference realized at the outset that it was something of a gamble. Whether it is a success or a failure, you, members of the audience, will decide on your return home. The Advisory Services, however, are determined that there will be no failure, that up and down the country its lessons should be translated into practice. Do not ask, however, at this juncture how this can be brought about. It must be a continuing, developing, theme that will require hard thinking by the Advisory Service. So much for the long term.

In recent years we, my colleagues and I, have been silent—as good Civil Servants should be—silent witnesses of what might be called these brotherly exchanges between boffin and breeder. Mr. Chairman, the Ministry have stayed on the sidelines long enough. We are going into action. A situation arose yesterday afternoon which seemed to need resolving. I therefore intend to ask the representatives of the two conflicting interests to meet round a table in the quiet and seclusion of a Whitehall room to settle their differences; and remember, when the Civil Service gets to work it is rather like a steam-roller—slow, ponderous, but it does iron things out.

Before I move on to my real task there is just one interpolation. Dr. Donald yesterday described the man who was doing a good job with livestock as C.B.—a constructive breeder. I understand the C.B.S.—Cattle Breeders' Services Limited—are about to change the heading on their notepaper to "Constructive Breeders' Services". If the result is a rise in income they will doubtless consider offering a royalty to Dr. Donald.

In a few moments that are left it is my pleasant duty to propose a very hearty vote of thanks to those who yesterday read their papers and to the members of the three Panels whose reports you have heard today. It would be invidious—nor have I time—to mention individuals; in all cases much time and labour has been involved in the past months and we—you and I—are all greatly indebted to those who have contributed in this way. I now ask you, by your applause, to show the warmth of your appreciation.

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